Monitoring report form for CDM project activity
(Version 07.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT		
Title of the project activity	Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia	
UNFCCC reference number of the project activity	2467	
Version number of the PDD applicable to this monitoring report	20.5	
Version number of this monitoring report	1.2	
Completion date of this monitoring report	25/03/2020	
Monitoring period number	3	
Duration of this monitoring period	01/01/2019 – 31/01/2020 inclusive of both days	
Monitoring report number for this monitoring period	1.0	
Project participants	KUB-Berjaya Enviro Sdn. Bhd. (KBE) ACT Commodities B.V. BP Gas Marketing Limited	
Host Party	Malaysia	
Applied methodologies and standardized baselines	• Applied methodologies: ACM0001 – "Flaring or use of landfill gas" (Version 18.0) • Standardized baselines: Not applicable	
Sectoral scopes	13 – Waste handling and disposal	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	Not applicable	162,420 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	299,732 tCO_2e	

SECTION A. Description of project activity

A.1. General description of project activity

The Bukit Tagar Sanitary Landfill (BTSL) is operated by KUB-Berjaya Enviro Sdn. Bhd. (KBE) and located in Hulu Selangor, Malaysia. The landfill receives municipal solid waste (MSW) from the country's capital, Kuala Lumpur and Selayang district in Selangor State.

The main objective for the Clean Development Mechanism (CDM) project is to avoid direct emissions of greenhouse gases (GHGs) from the landfill into the atmosphere through active extraction. The gas collected is destructed by high temperature enclosed flares as well as is used for power generation using Gas Engines with high efficiency.

Carbon emissions are reduced through two major activities:

Emission Reduction Aspects	How will emissions be reduced?
Landfill gas (LFG) Extraction and Destruction (Methane (CH_4) avoidance)	Instead of releasing LFG (consisting CH_4) to the atmosphere, the gas will be collected and destroyed in enclosed flares and Gas Engines
Power Generation (Fuel replacement)	Less carbon dioxide (CO_2) will be emitted by replacing electricity generated from grid power with electricity produced from LFG (considered as renewable)

LFG extraction from Phase 1, Phase 2 and 3 Cells has continued to operate during this monitoring period.

One (1) high temperature enclosed flare (Flare No. 2) with maximum capacity of 2,500 Nm3/hr is in operation during this monitoring period.

The remaining portion of the gas captured was sent to a unit of 1.2MW Gas Engine (Gas Engine No.1), 2 units of 1.56MW Gas Engines (Gas Engine No.2 and No.3) and one (1) unit of 2MW Gas Engines (Gas Engine No.4) to generate electricity. The electricity produced by the gas engines is exported to the grid.

The 3rd monitoring period of 2nd crediting period is from 01/01/2019 to 31/01/2020 (inclusive of both days). The total emission reductions achieved during this monitoring period is **162,420 tCO_2e.**

A.2. Location of project activity

Information	Description
Host Party(ies)	Malaysia
Region/ State/ Province, etc.	State of Selangor
City/ Town/ Community, etc.	Mukim Sg. Tinggi, District of Hulu Selangor The project location is situated approximately 5km to the west of the Bukit Tagar Interchange along the North-South Expressway and 40km from central Kuala Lumpur. The landfill is easily accessible via expressway and a dedicated Bukit Tagar Interchange has been developed for the access from the North-South Expressway. The landfill is situated in a leased agricultural land, surrounded by hectares of oil palm plantations and rubber trees.
Physical/ Geographical location	<table><tr><th>Latitude</th><th>Longitude</th><th>Description</th></tr><tr><td>3°30'168"</td><td>101°28'428"</td><td>North</td></tr><tr><td>3°29'07"</td><td>101°28'452"</td><td>South</td></tr><tr><td>3°29'46"</td><td>101°28'20"</td><td>West</td></tr><tr><td>3°29'69"</td><td>101°29'268"</td><td>East</td></tr></table>

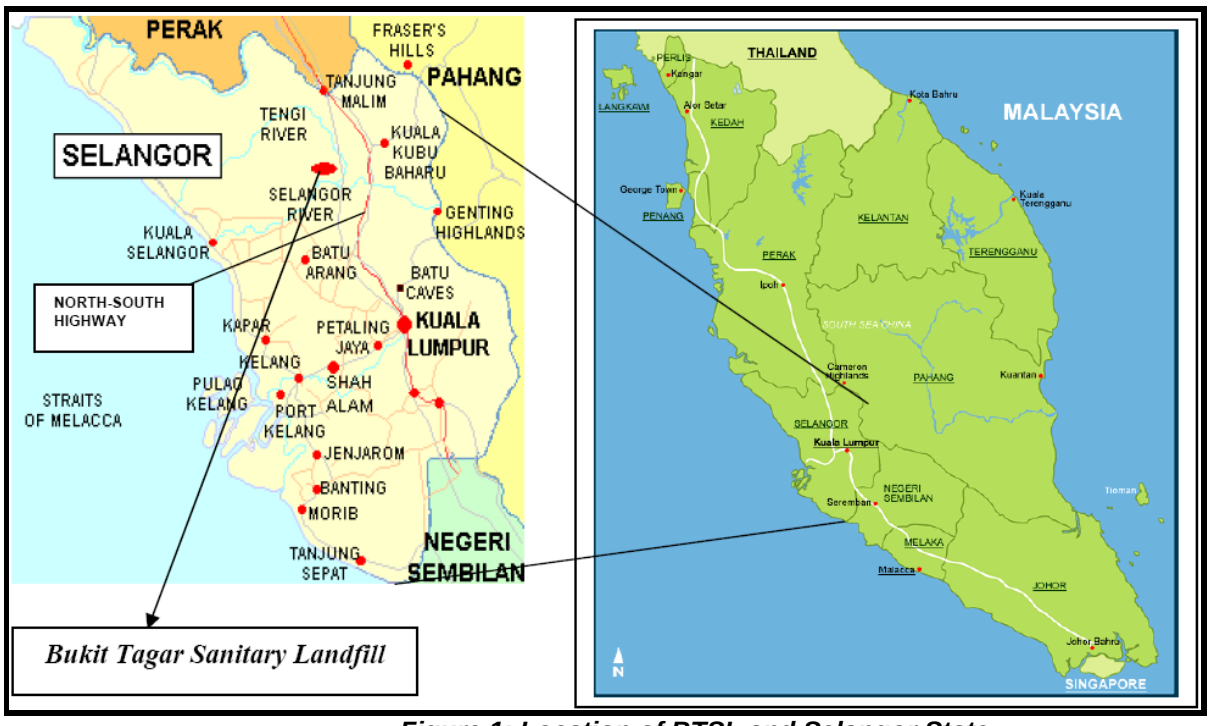


Figure 1: Location of BTSL and Selangor State

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Malaysia (Host Party)	KUB-Berjaya Enviro Sdn. Bhd. (KBE) (Private)	No
Netherlands	ACT Commodities B.V.	No
United Kingdom of Great Britain and Northern Ireland	BP Gas Marketing Limited	No

Note : Japan Carbon Finance, Ltd. (JCF) (Private) was removed from this table as JCF had withdrawn on 21/10/2013 (MoC Annex 2 Withdraw Project Participant) valid as of 25/10/2013) http://cdm.unfccc.int/Projects/DB/DNV-CUK1238680609.1/view

A.4. References to applied methodologies and standardized baselines

The project has applied the following approved methodology and tools:

Approved Methodology:

ACM0001: “Flaring or use of landfill gas – Version 18.0”

Methodological Tools referred to include:

- “Emissions from solid waste disposal sites” (*Version 07.0*)*;*
- “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (*Version 02.0*);
- “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (*Version 02*)
- “Project emissions from flaring” (*Version 02.0.0*);
- “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (*Version 03.0*); and
- “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (*Version 03.0.1*).

A.5. Crediting period type and duration

Date of Registration	28/08/2009
Type of Crediting Period	Renewable (7 Years)
1st Crediting Period	28/08/2009 – 27/08/2016 (Both dates inclusive)
2nd Crediting Period	28/08/2016 – 27/08/2023 (Both dates inclusive)

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The landfill is being developed in phases. The detail information on the phases is presented as below:

Cell	Status of Filling	Duration of Filling	Amount of Waste Disposed (t)
Advance Cell	Closed	Apr 2005 – Nov 2007	1,429,323.47
Phase 1	Closed	Nov 2007 – Dec 2011	3,730,406.57
Phase 2	Closed	Aug 2010 – Dec 2017	6,243,457.40
Phase 3	Operation	Jan 2018 - On-going	2,035,306.99 (Latest Dec 2019)

Relevant dates for the project activities tabulated below:

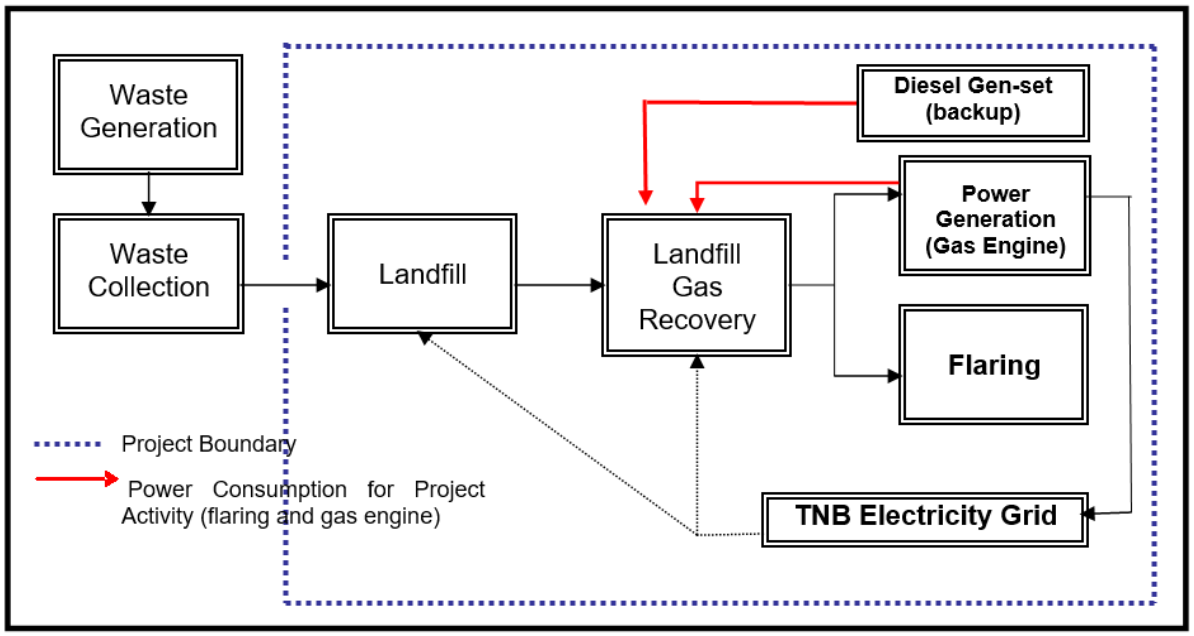
Bukit Tagar Project	Construction Start	Commissioned	Continued operation periods
Second flaring system (Flare No.2)	22/01/2010	07/08/2010	Continue to operate
Gas Engine No.1	03/01/2011 (delivery to site)	01/06/2011	Continue to operate
Gas Engine No.2	06/08/2012 (Signed-off Delivery Order)	06/12/2013[1]	Continue to operate
Gas Engine No.3	06/08/2012 (Signed-off Delivery Order)	06/12/2013[2]	Continue to operate
Gas Engine No.4	26/12/2014 (Signed-off Delivery Order)	26/10/2015[3]	Continue to operate

[1] Letter to Sustainable Energy Development Authority (SEDA) Malaysia on Notification on Initial Operation Date (IOD) Occurrence on 6th December 2013.

[2] Letter to Sustainable Energy Development Authority (SEDA) Malaysia on Notification on Initial Operation Date (IOD) Occurrence on 6th December 2013.

[3] Letter to Sustainable Energy Development Authority (SEDA) Malaysia on Notification on Initial Operation Date (IOD) Occurrence on 14th January 2016

The landfill gas recovery, flaring and power generation system can be illustrated below:



Note: Diesel generator which will be used as backup for project activities during the power failure of the grid is added into the chart

Figure 2: **Overall LFG Recovery, Flaring and Power Generation Design**

Description on the installed technologies

The technology applied and transferred into this project has been implemented and proven in Europe (Denmark and Germany) as well as in China (extraction and flaring system).

Detailed technical description is further described below:

Gas Extraction System in Advance Cell

Q2 Engineering Sdn. Bhd., a subsidiary of Q2 A/S of Denmark was appointed as the turnkey contractor to construct the gas extraction and flaring system for Advance Cell. 42 vertical gas extraction pipes were installed in the landfill to extract the LFG. These wells were connected to 8 units of main gas collection pipes that led to the LFG flaring system.

Figure 3: An Example of Vertical Well Installed in Advance Cell

These vertical wells can be individually regulated and controlled. Advanced cell has stopped operation and caped in this monitoring period.

Gas Extraction System in Phase 1 Cell

Stage 1 of Phase 1 Cell was completed in August 2010 and closed in December 2011. The gas extraction from phase 1 cell continued during this monitoring period. The design of the gas extraction wells is based on a series of horizontal gas extraction wells constructed over the entire Phase 1 Cell.

Figure 4: Horizontal Gas Extraction Wells in Phase 1 Cell

High-Temperature Enclosed Flaring System (Flare No.2)

The high-temperature enclosed flaring system was installed to cater for the extra LFG extracted from Phase 1 and 2 Cell. The flare system included a containerised blower and flaring system with a maximum capacity to flare off 2,500 Nm^3/hr LFG.

Figure 5: High-Temperature Enclosed Flares

Details of Flare No. 2 specifications are listed below:

Specifications	Details
Manufacturer	Fairyland Environmental Technology, China
Gas flow	Maximum – 2,500 Nm^3/hr
Retention time	>0.3 seconds at 800-1,000^oC
Gas blower	Twin-lobe roots blower
Gas analysers	Gas analysers for CH_4 and O_2

Gas Extraction System in Phase 2 Cell

Phase 2 Cell was completed in July 2010. 12 lines of horizontal wells with gas pipeline were installed in the landfill to extract the LFG. The cell stopped receiving waste started on December 2017. The design of the gas extraction wells is based on a series of horizontal gas extraction wells constructed over the cell.

Gas Extraction System in Phase 3 Cell

Phase 3 Cell was completed in Dec 2017. 28 lines of horizontal wells with gas pipeline were installed in the landfill to extract the LFG. Phase 3 cell still in operation during this monitoring period, the expected end of life span for phase 3 cell is December 2023.

Gas Analyser and Data Logging

Monitoring of the correct functioning of the flare system was provided by a continuous-logging system which examines the operational parameters of the flare. The gas analyzing system is a multi-functional environmental monitoring equipment that can monitor up to 14 different measurements and data logging channels. Data from the logging system was presented on a local screen (on-line data) and stored in a local personal computer (PC) unit with external communication via Global System for Mobile Communications (GSM).

Data were downloaded directly from the built-in data logger to a PC and were also transmitted to external server and PC as back-up.

Gas Engine Energy Power Plants

A high-efficiency (electrical efficiency > 42%) Gas Engine (net dispatch of 1 MW) was chosen for the generation of electricity from LFG.

Figure 6: Gas Engine 2 & 3

To ensure that good quality LFG arrives at Gas Engine No.1, LFG pre-treatment system comprising of a chiller (made in Germany) and activated carbon filter was also set up to remove moisture and impurities such as hydrogen sulphide (H_2S) and siloxanes before Gas Engines. A landfill gas blower was installed to ensure that the required gas pressure for Gas Engines are maintained. With the additional gas extraction of LFG in Phase 2, two (2) units of 1.56 MW gas engines were delivered to the site on 06/08/2012. The gas engines were commissioned on 06/12/2013. In addition to the new gas engines installation, an additional pipeline equipped with skid mounted LFG gas blower was installed in September 2012.

An additional 2MW gas engine was delivered to the site on 18/09/2015. The gas engine was commissioned on 26/10/2015. The details of specification for Gas Engines are tabulated below:

Specifications	Gas Engines		
	No.1	No.2 & 3	No.4
Manufacturer (Origin)	MWM (Germany)	MWM (Germany)	MTU
Model	TCG 2020V12	TCG 2020 V16	GB1948B5
Electric power output (net to grid)	1 MW (total max. gross output 1.2 MW)	1.56 MW	2 MW
Voltage	11 kV	415 V	11000 V
Frequency	50 Hz	50 Hz	50 Hz
Minimum heating value (LHV)	5.9 kWh/m^3	5.0 kWh/m^3	5.0 kWh/m^3

Centralised SCADA System

The Centralized (Supervisory Control and Data Acquisition) SCADA Interface was developed to integrate all existing SCADA or operation monitor system, ranging from individual Flare to Gas Engines. The objective of the integrated monitoring system is aimed to improve the efficiency of staff movement, monitoring process and data collection as well as serving as additional storage of database. The new system offered remote monitoring option which allows access through internet connection for view-only if provided with the correct authentication key.

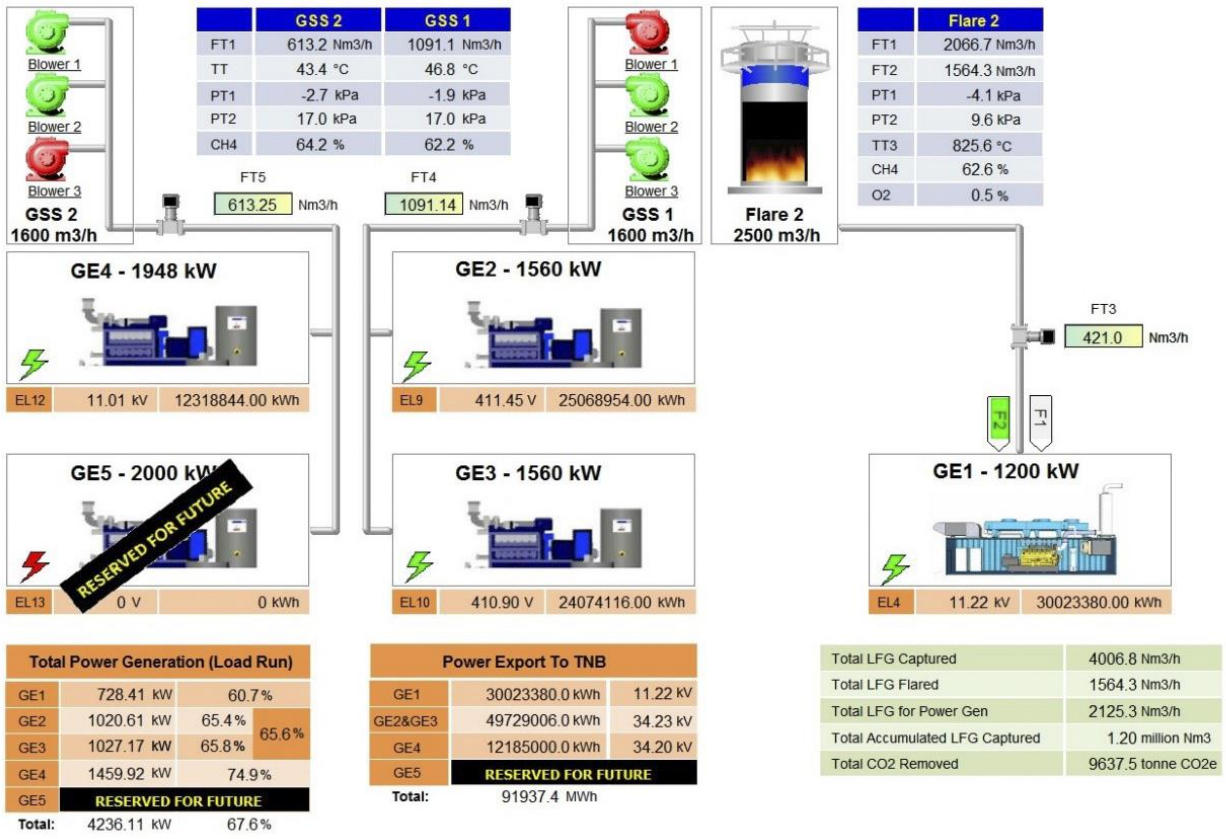


Figure 7: Centralized SCADA Interface

Implementation status of project activity

For the reporting period of 01/01/2019 to 31/01/2020, the key CDM activities implemented are described below:

Gas Extraction System in Phase 1, 2, and 3 Cells and Flare No.2

The flaring system in Phase 1 Cell was completed during the 2nd monitoring period and started its operation on 07/08/2010 during the 6th monitoring period of 1st crediting period. The LFG extracted from Phase 1, 2, and 3 Cells is transferred via a transfer pipe and fed to Flare No.2.

The total running time for Flare No.2 is 51% in this monitoring period. The shutdown of Flare No. 2 is due to the gas quality checking and gas stability testing.

The details on the downtime of the system (over the monitoring period covered by this report) are presented in **Appendix 1**.

Power Generation

During this monitoring period, power generated from Gas Engine No.1, No.2, and No.3 continued to be uploaded to the grid. Power generation from Gas Engine No.4 is considered zero during this monitoring period due to module faulty, major overhaul, electrical and upgrading works and monitoring procedure as per monitoring plan stated in PDD version 20.5, where the lower value between internal and external meter is taken for calculation. As there is no meter reading from external meter are available for Gas Engine No. 4, therefore, according to the PDD version 20.5, the lower value which is 0 is applied in the calculation.

Gas Engine No.4 was commissioned on 26/10/2015. The supply of landfill gas for Gas Engines comes from an independent piping system to GSSF1 (Gas Engine No.1), GSS1 (Gas Engine No.2 and No.3) and GSS2 (Gas Engine No. 4).

The properties of the landfill gas are monitored by independent monitoring equipment, i.e. temperature, pressure, methane content and flow rate for GSS1, GSS2, and GSSF1. The power generated from the gas engines is uploaded to the grid.

The total running time for Gas Engines in this monitoring period is tabulated as below:

No	Description	Total Running Time (%)
1	Gas Engine No. 1	53%
2	Gas Engine No. 2	77%
3	Gas Engine No. 3	87%
4	Gas Engine No. 4	14%

The shutdown of GEs mainly due to the major damage to engine block for GE No. 1, service and maintenance for GE No.2 and 3, module faulty, major overhaul, electrical and upgrading works for GE No. 4.

The details on the downtime of Gas Engine No.1, No.2, No.3, and No.4 are presented in **Appendix 2**.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

No temporary deviations have been applied during this monitoring period.

B.2.2. Corrections

No corrections during this monitoring period.

B.2.3. Changes to the start date of the crediting period

No changes to start date of crediting period during this monitoring period.

B.2.4. Inclusion of monitoring plan

No inclusion of a monitoring plan to the registered PDD that was not included at registration.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

Not applicable for this monitoring period.

B.2.6. Changes to project design

There is no change to project design of registered project activity during this monitoring period.

B.2.7. Changes specific to afforestation or reforestation project activity

Not applicable to this project activity.

SECTION C. Description of monitoring system

Monitoring Methodology

The basis of the monitoring plan (MP) was formulated based on the approved methodology ACM0001 – *Flaring or use of landfill gas (Version 18.0).*

Tool to determine the mass flow of a greenhouse gas in a gaseous stream

The MP referred to the *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*. Referring to the tools, for LFG temperatures below 60°C, moisture could be neglected due to its very low influence on final results and thus, the measurement in wet or dry basis are not important (as reflected in the amendments to ACM0001, version 9.1 onwards). In case where the LFG temperature exceeds 60°C, the same basis for both CH_4 concentration and flow measurement will be considered according to the tools.

The detailed description on the calculation applied to the CER Calculation Sheet is as shown in **Appendix 3**.

Transmission and Distribution Losses (TDL_y)

According to page 55 of the registered PDD, version 20.5, the Transmission and Distribution Losses ($TDL_{k,y}$) value applied in this project is 7.74% for 2019. This value was reported in the Tenaga Nasional Berhad (TNB)[4] Annual Report 2016[5].

Operation and Management Structure for Monitoring

The organization structure for the Bukit Tagar CDM monitoring team is shown below:

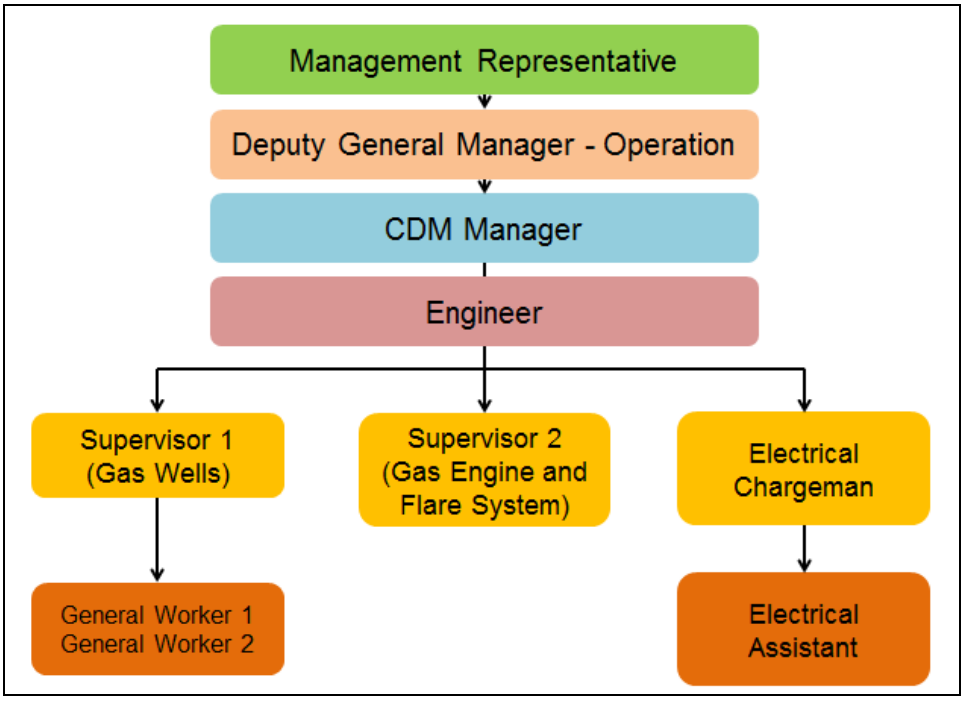


Figure 8: Organisational Structure for CDM Monitoring for BTSL LFG Recovery and Utilisation Project

[4] Tenaga Nasional Berhad is the largest electricity provider in Malaysia and is responsible for the grid transmission and distribution in Peninsular Malaysia.
[5] https://www.tnb.com.my/assets/annual_report/TNB_Annual_Report_2016.pdf

The roles and responsibilities of the monitoring team in carrying out the MP are detailed as follow:

Table 1: Responsibilities of the CDM Monitoring Team

Role	Responsibility in CDM monitoring
Management Representative	• Reports to and obtain decisions from management on CDM-related matters • Chairs internal meetings on CDM matters • Signs off official correspondence for external parties
Deputy General Manager - Operation	• Reports to the management representative (MR) • Oversees entire operation of landfills (including LFG management system) • Covers responsibility of CDM Manager when he is not available
CDM Manager	• Reports to the Deputy General Manager - Operation • Oversees and coordinates the entire CDM monitoring plan • Verifies and signs off all relevant monitoring records • Ensures Quality Control / Quality Assurance (QC/QA) is carried out • Ensures all data are recorded and necessary documentations are prepared according to the requirements of CDM monitoring • Responsible in optimising the LFG extraction and utilisation system
Engineer	• Reports to the CDM Manager • Assists the CDM Manager in performing CDM monitoring works • To monitor daily operation for landfill gas operations • To assist in daily monitoring records for all CDM related equipment • To prepare daily summary record for landfill gas operation
CDM Consultant	• Provides advice on all CDM-related matters • Prepares monitoring reports for verifications • Liaises with the verifier on verification process • Conducts regular audits on CDM monitoring
Supervisors	• Report to the CDM Manager on CDM monitoring issues • Check and ensure that the flaring system is functional • Ensure all data recording devices are functioning and calibrated as planned (including performing QA/QC) • Check and sign the daily monitoring log sheets for CDM monitoring • Supervise general workers in maintenance work and record monitored parameters for CDM monitoring • Identify maintenance requirement and contact the supplier if maintenance and support are needed • Optimise the flare operation together with the CDM Manager • Responsible with the security of locked Programmable Logic Controller (PLC) control room. The supervisor will hold the door key for the PLC control room
General Workers	• Perform regular operational and maintenance tasks • Record necessary readings in daily monitoring log sheets and request verification from the supervisors on the log sheets • Report any fault to supervisor-in-charge or the electrical chargeman

The team is overall headed by the MR who oversees the entire CDM monitoring implementation. The MR receives direct updates and support from the site staff headed by the Deputy General Manager - Operation. The Deputy General Manager – Operation is supported by the CDM Manager who is the key coordinator to all CDM monitoring matters on-site. The CDM Manager is assisted by an engineer, a group of technicians and workers who will perform the daily recording and checking tasks.

The CDM Consultant (Eco-Ideal Consulting Sdn. Bhd.) was appointed to assist KBE in ensuring that the monitoring plan and requirements were done according to the MP. The consultant played the role of a trainer and conducted independent audits as part of the QA/QC procedures set up for this project. During this monitoring period, two (2) CDM Management Meeting was held on 29/04/2019 and 17/06/2019 respectively.

Relevant Monitoring Points

The parameters monitored during the monitoring period are illustrated in the following figure:

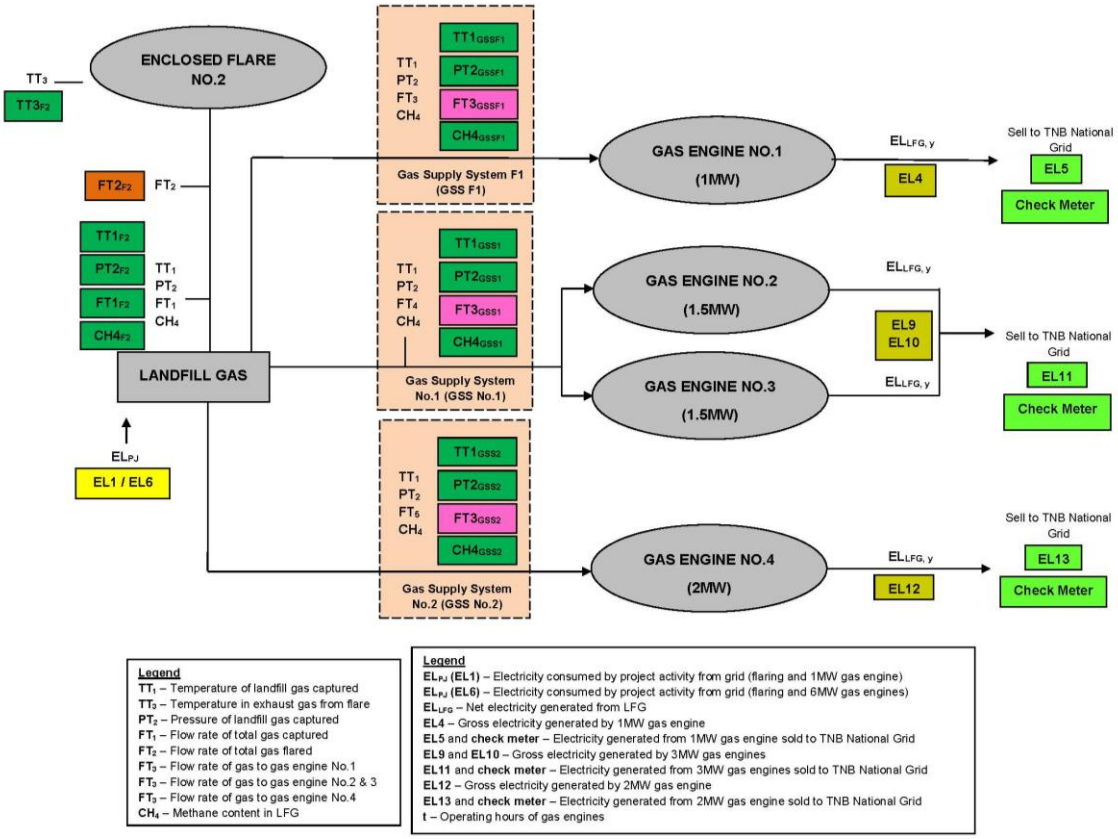


Figure 9: Key Parameters Monitored under the CDM Monitoring Plan

Landfill gas is captured and send to Enclosed Flare No.2, Gas Supply System F1 (GSSF1), Gas Supply System No. 1 (GSS No.1) and Gas Supply System No.2 (GSS No.2). Flow rate of total gas flared by Enclosed Flare No.2 is monitored by FT2 while flow rate of gas to gas engines are monitored by $FT3_{GSSF1}$ (GSS F1), $FT3_{GSS1}$ (GSS No.1) and $FT3_{GSS2}$ (GSS No.2) respectively.

The gross electricity generated by each gas engines are monitored using EL4, EL9, EL10 and EL12. The amount will be compared with EL5, EL11 and EL13 which are managed by Tenaga National Berhad to obtain the lower amount so that the result is conservative.

As data will be captured separately in the flaring and power generation system (Flare No.2, Gas Engine No.1 and so forth), a specific subscript will be assigned to the monitoring parameters of the different equipment installed.

Relevant regulations on LFG project activities shall be monitored and updated upon renewal of each crediting period. Changes to regulations, if any will be converted to the amount of methane in the LFG which is flared in the baseline due to a requirement in year *y* ($F_{CH4,BL,R,y}$).

Data Recording and Documentation

All relevant data/measurements of the parameters taken were recorded and kept in an appropriate format and archived after the crediting period to ensure that the data are accessible especially during the monitoring and verification process of the project.
Data was recorded in the following way:

Continuous Monitoring – Data in Softcopy:
Data logger (automatic recording in computer)

Manual Recording – Data in Hardcopy:
Daily monitoring log sheets and record books (manual recording)

Based on the MP, key parameters (temperature, pressure, flow of gas, CH_4 concentration in biogas) were continuously monitored and recorded via the data logger at the control room.

As a back-up data recording system, the on-site workers were required to manually record certain monitored parameters in daily monitoring log sheets. These records were filed and kept in the office which can be accessible by the CDM Manager and technicians whenever necessary. These log sheets (in hard copies) were scanned for electronic filing on a monthly basis.

A summary of the data directly monitored is tabulated below:

Table 2: CDM Monitoring Parameters, Frequency and Archiving

Parameter	CDM ID	Equipment ID	Monitoring equipment	Recording frequency	Documentations	Data archive
Temperature	T_t ($T_{TT1,F2}$) T_t ($T_{TT1,GSS1}$) T_t ($T_{TT1,GSS2}$) T_t ($T_{TT1,GSSF1}$)	$TT_{1,Flare}$ No.2/GSS1/GSS2/GSSF1	Thermocouple	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving
Flare Temperature	$T_{EG,m}$ ($T_{Flare,F2}$)	$TT_{3,Flare}$ Flare No.2	Thermocouple	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving
Pressure	P_t ($P_{PT2,F2}$) P_t ($P_{PT2,GSS1}$) P_t ($P_{PT2,GSS2}$) P_t ($P_{PT2,GSSF1}$)	$PT_{2,Flare}$ No.2/GSS1/GSS2/GSSF1	Pressure Gauge	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving

Parameter	CDM ID	Equipment ID	Monitoring equipment	Recording frequency	Documentations	Data archive
Flowrate	$V_{t,wb}$ ($LFG_{total,\ Flare\ No.2,y}$) $V_{t,wb}$ ($LFG_{flare,\ Flare\ No.2,y}$) $V_{t,wb}$ ($LFG_{electricity,Flare\ No.2/GSS,y}$)	$FT_{1,Flare\ No.2}$ $FT_{2,\ Flare\ No.2}$ $FT_{3,Flare\ No.2/GSS1/GSS2/GSS\ F1}$	V-Cone Differential Pressure Flowmeter	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving
Methane Fraction	$V_{CH4,m,db}$ ($W_{CH4,Flare\ No.2/GSS,y}$)	$CH_{4,Flare\ No.2/GSS1/GSS2/GSS\ F1}$	Continuous Infrared Gas Analyser	Every 1 min (auto) Daily (manual) – as back-up	Softcopy Hardcopy	(.MDB MS Access database) Daily log sheet will be scanned into PDF format for archiving
Electricity consumed by the project	$EG_{PJ,y}$ ($EL_{PJ,y}$)	EL_{PJ} (EL1, EL6)	kWh meter	Daily (manual)	Softcopy (scanned copy) Hardcopy	Data recorded will be compiled into MS Excel and aggregated for monthly amount Daily log sheet will be scanned for archiving
Electricity generated by LFG	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.1,y}$) $EG_{PJ,y}$ ($EL_{LFG,GE\ No.2,y}$) $EG_{PJ,y}$ ($EL_{LFG,GE\ No.3,y}$) $EG_{PJ,y}$ ($EL_{LFG,GE\ No.4,y}$)	$EL_{LFG,GE\ No.1}$ (EL4) $EL_{LFG,GE\ No.2}$ (EL9) $EL_{LFG,GE\ No.3}$ (EL10) $EL_{LFG,GE\ No.4}$ (EL12)	kWh meter	Daily (manual)	Softcopy (scanned copy) Hardcopy	Data recorded will be compiled into MS Excel and aggregated for monthly amount Daily log sheet will be scanned for archiving
	$EG_{PJ,y}$ ($EL_{LFG,y}$)	EL_{LFG} (EL5, EL11 and EL13, TNB main energy meters) TNB check energy meters	kWh meter	Daily (manual)	Softcopy (scanned copy) Hardcopy	TNB joint meter reading certificate will be scanned for archiving

NOTE:

Data recorded by the flow meters were normalised to Nm^3 with the temperature and pressure monitored automatically via the software. Thus, there was no need to normalise the recorded flow further.

Monitoring Equipment and Equipment Calibration

The list of CDM monitoring equipment used is shown in Table 3 below.

Table 3: List of CDM Monitoring Equipment and *Calibration* for Flare No.2

No	Item	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Accuracy	Range	Last Calibration Date & Cert No.	Recommended Next Calibration Date	Recommended Frequency of Calibration
Flare System													
1	Temperature Transmitter	Temperature (T)	$TT_{1,Flare\ No.2}$	T_t ($T_{TT1,F2}$)	^0C	Honeywell	STT25M-0-EN0-000-000-000-00-3D	B839917437	±0.5% of span	0-100°C	11/10/2018 & CTT 3123-18 (01/01/2019- 17/09/2019)	10/10/2019	Annually
											18/09/2019 & CTT 3709-19 (18/09/2019 - 31/01/2020)	17/09/2020	Annually
2	Temperature Transmitter	Flare Temperature ($T_{flare,y}$)	$TT_{3,Flare\ No.2}$	$T_{EG,m}$ ($T_{Flare,F2}$)	^0C	Honeywell	STT25M-0-EN0-000-000-000-00-3D	B838901937	±0.5% of span	0-1200°C	11/10/2018 & CTT 3124-18 (01/01/2019 - 17/09/2019)	10/10/2019	Annually
											18/09/2019 & CTT 3710 -19 (18/09/2019 - 31/01/2020)	17/09/2020	Annually
3	Pressure Sensor	Pressure Transmitter (P)	$PT_{2,Flare\ No.2}$	P_t ($P_{PT2,F2}$)	kPa	Rosemount	3051TG1A2B21AB4E5Q4	5584784	±0.25%	0-40 kpa	11/10/2018 & CTP 5488-18 (01/01/2019 - 17/09/2019)	10/10/2019	Annually
							3051TG1A2B21AB4K5M5	5916057	±0.1%	0-40 kpa	18/09/2019 & CTP 5856-19 (18/09/2019 - 31/01/2020)	17/09/2020	Annually
4	Flow Meter	Total Biogas Flow Rate ($LFG_{total,y}$)	$FT_{1,Flare\ No.2}$	$V_{t,wb}$ ($LFG_{total,Flare\ No.2,y}$)	NM^3/hr	Flow transmitter – Rosemount Differential Pressure Transmitter – Kingways Control Vcone	3051CD1A22A1AM5K5Q4	4972946 / FT119 (8102101)	±1%	3-5000Nm^3/h	04/06/2018 & CTP 3706 - 18 (01/01/2019 -31/01/2020)	03/06/2020	24 months
5	Flow Meter	Flaring Biogas Flow Rate ($LFG_{flare,y}$)	$FT_{2,Flare\ No.2}$	$V_{t,wb}$ ($LFG_{flare,Flare\ No.2,y}$)	NM^3/hr	Flow transmitter – Rosemount Differential Pressure Transmitter – Kingways Control Vcone	3051CD1A22A1AM5B5R4	5476627 / FT140 (10031701)	±0.5%	3-5000Nm^3/h	04/06/2018 & CTP3705 - 18 (01/01/2019 - 31/01/2020)	03/06/2020	24 months
Gas Analysers													
6	CH_4 Meter	Methane fraction of LFG	$CH_{4,Flare\ No.2}$	$V_{CH4,m,db}$ ($W_{CH4,Flare\ No.2,y}$)	%	Guardian Plus	97460	31453	±2% of full scale	0-100%	04/06/2018 & CTM 1296-18 (01/01/2019 - 17/09/2019)	03/06/2019	Annually
								33542	±2% of full scale	0-100%	18/09/2019 & CTM 1609-19 (18/09/2019 - 31/01/2020)	17/09/2020	Annually

During this monitoring period, maximum permission error are applied for the equipment which has a delay calibration as conservative approach is as listed below:

1. CH4 - due to delay in calibration, the maximum permissible error of ±2.0% which is the equipment accuracy error was applied to CH4 from 03/06/2019 – 17/09/2019 as a conservative approach.

Table 4: List of CDM Monitoring Equipment and Calibration for GSS1 (GE No. 2 and GE No. 3)

No	Item	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Accuracy	Range	Last Calibration Date & Cert No.	Recommended Next Calibration Date	Recommended Frequency of Calibration
Gas Supply System													
1	Temperature Transmitter	Temperature (T)	$TT_{1,GSS1}$	T_t ($T_{TT1,GSS1}$)	^0C	Honeywell	STT25M-0-ENS-000-000-000-00-3H	B527143837	±1%	0-100°C	11/10/2018 & CTT 3125- 18 (01/01/2019-17/09/2019)	10/10/2019	Annually
											18/09/2019 & CTT 3711-19 (18/09/2019 - 31/01/2020)	17/09/2020	Annually
2	Pressure Sensor	Pressure Transmitter (P)	$PT_{2,GSS1}$	P_t ($P_{PT2,GSS1}$)	kPa	Rosemount	3051TG1A2B21AB4K5M5	5916057	±0.1%	0-60 kPa	11/10/2018 & CTP 5489- 18 (01/01/2019-17/09/2019)	10/10/2019	Annually
							3051TG1A2B21AB4E5Q4	5584784	±0.25%	0-40 kpa	11/10/2018 & CTP 5488-18 (18/09/2019 - 31/01/2020)	10/10/2019	Annually
3	Flow Meter	Flow Rate of Total Gas to Energy ($LFG_{electricity,y}$)	$FT_{3,GSS1}$	$V_{t,wb}$ ($LFG_{electricity,GSS1,y}$)	NM^3/hr	Rosemount	3051 CD1A22A1AM5B4DFK5	5988022	±0.5%	200-2,000 Nm^3/h	11/10/2018 & CTP 5490-18 (01/01/2019 - 31/01/2020)	10/10/2020	24 months
4	CH_4 Meter	Methane fraction of LFG	$CH_{4,GSS1}$	$V_{CH4,m,db}$ ($W_{CH4,GSS1,y}$)	%	Edinburgh	Guardian NG	14464	±2% of full scale	0-100%	27/12/2018 & AL-ED/0185-1218 (01/01/2019 - 25/07/2019)	26/12/2019	Annually
						Guardian Plus	97460	33436	±2% of full scale	0-100%	26/07/2019 & AL-E/0198-0719 (26/07/2019 - 31/01/2020)	25/07/2020	Annually
Power Generation and Electricity Consumption													
5	Power meter	Grid for project activity	EL_{PJ} (EL6)	$EG_{EC,y}$ ($EL_{PJ,y}$)	kWh	IME	NEMO 96HO+	2661930098	Class 1 (±1%)	0-250/5A	25/01/2018 &SP/RA/2018/065/002 (01/01/2019 - 31/01/2020)	24/01/2021	36 months
6	Power meter	Gross generation from GE No.2	$EL_{LFG,GE\ No.2}$ (EL9)	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.2,y}$)	kWh	EDMI Limited	MK6G Genius	211516862	Class 0.5S	99999999.99kWh	25/01/2018 & SP/RA/2018/065/003 (01/01/2019 - 31/01/2020)	24/01/2020	24 months
7	Power meter	Gross generation from GE No.3	$EL_{LFG,GE\ No.3}$ (EL10)	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.3,y}$)	kWh	EDMI Limited	Genius	211516863	Class 0.5S	99999999.99kWh	25/01/2018 & SP/RA/2018/065/004 (01/01/2019 - 31/01/2020)	24/01/2020	24 months
8	Power meter	Electricity sold to grid (MWh) - recorded by grid operator	EL_{LFG} (EL11)	$EG_{PJ,y}$ ($EL_{LFG,y}$)	kWh	EDMI Limited	Mk6E	908705152	Class 0.5S	99,999,999kWh	06/12/2009 & TNBM/PJ/09/076 (01/01/2019 - 31/01/2020)	05/12/2014	5 years
9	Power meter	Electricity sell to grid (MWh) - check energy meter recorded by grid operator	-	-	kWh	EDMI Limited	Mk6E	908705154	Class 0.5S	99,999,999kWh	06/12/2009 & TNBM/PJ/09/076 (01/01/2019 - 31/01/2020)	05/12/2014	5 years

During this monitoring period, maximum permission error are applied for the equipment which has an delay calibration as conservative approach is as listed below:

1. PT2 - Due to delay in calibration, the maximum permissible error of 0.25% which is the equipment accuracy error was applied to PT2 from 10/10/2019 - 31/01/2020 as a conservative approach
2. EL9 - Due to delay in calibration, the maximum permissible error of 0.5% which is the equipment accuracy error was applied to EL9 from 24/01/2020 - 31/01/2020 as a conservative approach.
3. EL10 - Due to delay in calibration, the maximum permissible error of 0.5% which is the equipment accuracy error was applied to EL10 from 24/01/2020 - 31/01/2020 as a conservative approach.
4. EL11 - Due to delay in calibration, the maximum permissible error of 0.5% which is the equipment accuracy error was applied to EL11 from 01/01/2019 - 31/01/2020 as a conservative approach.

Table 5: List of CDM Monitoring Equipment and Calibration for GSS2 (GE No. 4)

No	Item	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Accuracy	Range	Last Calibration Date & Cert No.	Recommended Next Calibration Date	Recommended Frequency of Calibration
Gas Supply System													
1	Temperature Transmitter	Temperature (T)	$TT_{1,GSS2}$	T_t ($T_{TT1,GSS2}$)	^0C	Autrol	ATT2100-S11HA3E1-M1	ATT21004151000	±0.1%	0-100°C	04/06/2018 & CTT 2120-18 (01/01/2019 - 17/09/2019)	03/06/2019	Annually
											18/09/2019 & CTT 3712-19 (18/09/2019 - 31/01/2020)	17/09/2020	Annually
2	Pressure Sensor	Pressure Transmitter (P)	$PT_{2,GSS2}$	P_t ($P_{PT2,GSS2}$)	kPa	Autrol	APT3200-G4M11E11S1-M1	APT3200-4150998	±0.075% of span	-100-1,500kPa	04/06/2018 & CTP 3662 -18 (01/01/2019 - 17/09/2019)	03/06/2019	Annually
											18/09/2019 & CTP 5857-19 (18/09/2019 - 31/01/2020)	17/09/2020	Annually
3	Flow Meter	Flow Rate of Total Gas to Energy ($LFG_{electricity,y}$)	$FT_{3,GSS2}$	$V_{t,\ wb}$ ($LFG_{electricity,GSS2,y}$)	NM^3/hr	Binder	EIA-C100000-1MA100-D1104501-21BS2410	C150327	2.5% of reading + 0.2% of full scale	0.25-25 Nm/s	10/12/2018 & C150327 (01/01/2019 - 31/01/2020)	09/12/2020	24 months
Gas Analyser													
4	CH_4 Meter	Methane fraction of LFG	$CH_{4,GSS2}$	$V_{CH4,m,db}$ ($W_{CH4,GSS2,y}$)	%	Guardian Plus	97460	33542	±2% of full scale	0-100%	11/10/2018 & CTM 1628-18 (01/01/2019 - 12/09/2019)	10/10/2019	Annually
						Edinburgh	Guardian NG	14464	±2% of full scale	0-100%	27/12/2018 & AL-ED/0185-1218 (13/09/2019 - 31/01/2020)	26/12/2019	Annually
Power Generation and Electricity Consumption													
5	Power meter	Gross generation from GE No.4	$EL_{LFG,GE\ No.4}$ (EL12)	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.4,y}$)	kWh	EDMI	2000-6N00-30A31-04-L00-02A2-1D	213545834	Class 0.5S	99999999.99kWh	08/08/2018 & SP/RA/2018/463/001-001 (01/01/2019 - 31/01/2020)	07/08/2020	24 months
6	Power meter	Electricity sold to grid (MWh) - recorded by grid operator	EL_{LFG} (EL13)	$EG_{PJ,y}$ ($EL_{LFG,y}$)	kWh	Itron	SL761W071	81480576	Class 0.2S	999999999kWh	14/06/2016 & TNB(B)/PP/UPH-PJ17/6/7-141 (01/01/2019 - 31/01/2020)	13/06/2021	5 years
7	Power meter	Electricity sell to grid (MWh) - check energy meter recorded by grid operator	-	-	kWh	Itron	SL761W071	81480578	Class 0.2S	999999999kWh	14/06/2016 & TNB(B)/PP/UPH-PJ17/6/7-141 (01/01/2019 - 31/01/2020)	13/06/2021	5 years

During this monitoring period, maximum permission error are applied for the equipment which has an delay calibration as conservative approach is as listed below:

1. TT1 - Due to delay calibration, the maximum permissible error of ±0.1% which is the equipment accuracy error was applied to TT1 from 03/06/2019 - 17/09/2019 as a conservative approach.
2. PT2 - Due to delay calibration, the maximum permissible error of ±0.075% which is the equipment accuracy error was applied to PT2 from 03/06/2019 - 17/09/2019 as a conservative approach.
3. CH4 - Due to delay calibration, the maximum permissible error of ±2% which is the equipment accuracy error was applied to CH4 from 26/12/2019 - 31/01/2020

Table 6: List of CDM Monitoring Equipment and Calibration for GSSF1 (GE No. 1)

No	Item	Parameters	Equipment ID	CDM Monitoring ID	Unit	Manufacturer	Model No.	Serial No.	Accuracy	Range	Last Calibration Date & Cert No.	Recommended Next Calibration Date	Recommended Frequency of Calibration
Gas Supply System													
1	Temperature Transmitter	Temperature (T)	$TT_{1,GSS\ F1}$	T_t ($T_{TT1,\ GSS\ F1}$)	^0C	PR Electronics	5335A	100944768	$\leq \pm$ 0.05% of span	0-100°C	04/06/2018 & CTT 2119-18 (01/01/2019 - 17/09/2019)	03/06/2019	Annually
											18/09/2019 & CTT 3708-19 (18/09/2019 -31/01/2020)	17/09/2020	Annually
2	Flow Meter	Flow Rate of Total Gas to Energy ($LFG_{electricity,y}$)	$FT_{3,\ GSS\ F1}$	$V_{t,\ wb}$ ($LFG_{electricity,GSS\ F1,y}$)	NM^3/hr	Flow transmitter – Rosemount Differential Pressure Transmitter – Kingways Control Vcone	3051CD1A22A1AM5B4K5Q4 / KVS08IIKC23FSN	02768007 / FT161 (11011001)	+0.5%	200-2000Nm^3/h	05/01/2017 & CTP 1006-17 (01/01/2019 - 17/09/2019)	04/01/2019	24 months
											18/09/2019 & CTP 5855-19 (18/09/2019 - 31/01/2020)	17/09/2021	24 months
3	Pressure Sensor	Pressure Transmitter (P)	$PT_{2,\ GSS\ F1}$	P_t ($P_{PT2,\ GSS\ F1}$)	kPa	Rosemount	3051TG1A2B21AB4E5M5Q4	02492864	+0.25%	0-2 to 0-207 kPa	04/06/2018 & CTP 3661-18 (01/01/2019 - 17/09/2019)	03/06/2019	Annually
											18/09/2019 & CTP 5854-19 (18/09/2019 - 31/01/2020)	17/09/2020	Annually
Gas Analysers													
4	CH4 Analyser	Methane fraction of LFG	$CH_{4,\ GSS\ F1}$	$V_{CH4,\ m,\ db}$ ($W_{CH4,GSS\ F1,y}$)	%	Geotech (Portable)	GA5000	G505823	±1.5%	0-100%	25/10/2018 & G505823_2/21707 (01/01/2019 - 12/09/2019)	24/10/2019	Annually
						Cubic- Ruiyi	Gasboard-3200	2190 5310 2610 0000 0001	<1.0%	0-100%	05/06/2019 & 2019060507 (13/09/2019 - 31/01/2020)	04/06/2020	Annually
Power Generation and Electricity Consumption													
5	Power meter	Total electricity generation (MWh) - recorded by project site (Backup)	$EL_{LFG,GE\ No.1}$ (EL1)	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.1,y}$)	kWh	IME Nemo	96HD+	2167890035	Class 0.5S	99999999.99kWh	25/01/2018 & SP/RA/2018/065/001-004 (01/01/2019 - 31/12/2019)	24/01/2021	36 months
6	Power meter	Total electricity generation (MWh) - recorded by project site	$EL_{LFG,GE\ No.1}$ (EL4)	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.1,y}$)	kWh	EDMI	Genius	210225256	Class 0.5S	99999999.99kWh	06/01/2017 & SP/RA2017/014/001-001 (01/01/2019 - 13/03/2019)	06/01/2019	24 months
											14/03/2019 & SP/RA2019/146/001-001 (14/03/2019 - 31/01/2020)	13/03/2021	24 months
7	Power meter	Electricity sell to grid (MWh) - recorded by grid operator	EL_{LFG} (EL5)	$EG_{PJ,y}$ ($EL_{LFG,y}$)	kWh	Itron	SL761A071	53099690	Class 0.20	999999999kWh	01/04/2011 & TNBM-QR-064 (01/01/2019 - 31/01/2020)	31/03/2016	5 years
8	Power meter	Electricity sell to grid (MWh) - check energy meter recorded by grid operator	-	-	kWh	Itron	SL761A071	53099691	Class 0.20	999999999kWh	01/04/2011 & TNBM-QR-064 (01/01/2019 -31/01/2020)	31/03/2016	5 years

During this monitoring period, maximum permission error are applied for the equipment which has an delay calibration as conservative approach is as listed below:

1. TT1 - due to delay in calibration, the maximum permissible error of ±0.2% which is the calibration error was applied to TT1 from 03/06/2019 – 17/09/2019 as a conservative approach.
2. PT2 - due to delay in calibration, the maximum permissible error of ±0.25% which is the equipment accuracy error was applied to PT2 from 03/06/2019 – 17/09/2019 as a conservative approach.
3. FT3 - due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to FT3 from 04/01/2019 – 17/09/2019 as a conservative approach.
4. EL4 - due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to EL4 from 06/01/2019 – 13/03/2019 as a conservative approach.
5. EL5 - due to delay in calibration, the maximum permissible error of ±0.2% which is the equipment accuracy error was applied to EL5 from 01/01/2019 – 31/01/2020 as a conservative approach.

With reference to the CDM validation and verification standard for project activities, version 02.0, section 9.2.6, paragraph 366 (a), “Applying the maximum permissible error of the instrument to the measured values taken during the period between the scheduled date of calibration and the actual date of calibration, if the results of the delayed calibration do not show any errors in the measuring equipment, or if the error is smaller than the maximum permissible error”, or (b) “Applying the error identified in the delayed calibration test, if the error is beyond the maximum permissible error of the measuring equipment”. During this monitoring period, all the equipment which had a delay in calibration, the maximum permissible error (MPE) or the error identified in the delayed in calibration are as listed below:

List of Equipment from Flare 2

1. CH4 - due to delay in calibration, the maximum permissible error of ±2.0% which is the equipment accuracy error was applied to CH4 from 03/06/2019 – 17/09/2019 as a conservative approach.

List of Equipment from GSS1

1. PT2 - due to delay in calibration, the maximum permissible error of ±0.25% which is the equipment accuracy error was applied to PT2 from 10/10/2019 – 31/01/2020 as a conservative approach.
2. EL9 - Due to delay in calibration, the maximum permissible error of 0.5% which is the equipment accuracy error was applied to EL9 from 24/01/2020 - 31/01/2020 as a conservative approach.
3. EL10 - Due to delay in calibration, the maximum permissible error of 0.5% which is the equipment accuracy error was applied to EL10 from 24/01/2020 - 31/01/2020 as a conservative approach.

List of Equipment from GSS2

1. TT1 - Due to delay calibration, the maximum permissible error of ±0.1% which is the equipment accuracy error was applied to TT1 from 03/06/2019 - 17/09/2019 as a conservative approach.
2. PT2 - Due to delay calibration, the maximum permissible error of ±0.075% which is the equipment accuracy error was applied to PT2 from 03/06/2019 - 17/09/2019 as a conservative approach.
3. CH4 - Due to delay calibration, the maximum permissible error of ±2% which is the equipment accuracy error was applied to CH4 from 26/12/2019 - 31/01/2020

List of Equipment from GSSF1

1. TT1 - due to delay in calibration, the maximum permissible error of ±0.2% which is the calibration error was applied to TT1 from 03/06/2019 – 17/09/2019 as a conservative approach.
2. PT2 - due to delay in calibration, the maximum permissible error of ±0.25% which is the equipment accuracy error was applied to PT2 from 03/06/2019 – 17/09/2019 as a conservative approach.
3. FT3 - due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to FT3 from 04/01/2019 – 17/09/2019 as a conservative approach.
4. EL4 - due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to EL4 from 06/01/2019 – 13/03/2019 as a conservative approach.

With reference to the CDM validation and verification standard for project activities, version 02.0, section 9.2.6, paragraph 368, “If the results of the delayed calibration are not available, or the calibration has not been conducted at the time of the verification, the DOE, prior to finalizing the verification, shall request the project participants to conduct the required calibration and shall determine whether the project participants have calculated GHG emission reductions or net anthropogenic GHG removals conservatively using the approach mentioned in paragraph 366 above”.

During this monitoring period, there are equipment which are not within the control of the project owner and the calibration have not been conducted at the time of verification. The equipment is as listed below:

List of Equipment from GSSF1

1. EL5 (Itron, serial no.: 53099690) – The meter is owned by the grid operator, TNB and thus, it is not within the control of the project owner. However, due to delay in calibration, the maximum permissible error of ±0.2% which is the equipment accuracy error was applied to EL5 from 01/01/2019 – 31/01/2020 as a conservative approach.

List of Equipment from GSS1

1. EL 11 (EDMI Limited, serial no.: 908705152) – The meter is owned by the grid operator, TNB and thus, it is not within the control of the project owner. However, due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to EL11 from 01/01/2019 – 31/01/2020 as a conservative approach.

Data Collection (for the whole monitoring period)

Based on the monitoring plan, key flaring parameters (temperature, pressure, flow of gas, CH_4 concentration in LFG) were continuously monitored and recorded via the data logger at the flare system control room. Continuous flaring data were logged and archived in every minute in the database file. These raw data were compiled and analysed for the calculation of Certified Emission Reductions (CERs).

As a back-up data recording system, the on-site workers have manually recorded certain monitored parameters in the Daily Monitoring Log Sheets. These records were scanned into soft copies for electronic filing on a monthly basis.

Data recorded manually (not recorded in the data logger system), i.e. electricity consumed were recorded in daily monitoring log sheets on a daily basis and compiled in Microsoft (MS) Excel format weekly.

Data Processing

The data logged were archived in .db file format and compiled.

Data recorded were further processed to yield the results required. A specific computation programme (in MS Access) was developed by the CDM Consultant to process continuously-monitored data to the required format and summary. An example of data aggregation on-site for flow rate of LFG at the main pipe is shown as follows:

Parameter: FT_1 (Flow rate of LFG at main pipe)

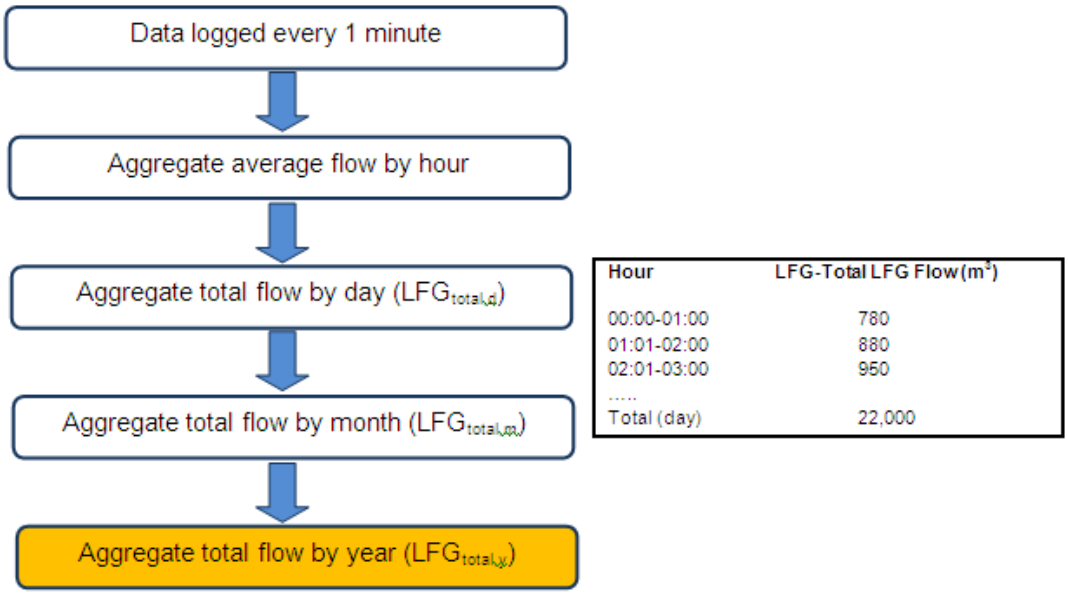


Figure 10: Example of Data Aggregation for Continuous Monitoring

Raw data logged at one (1) minute's interval were used to compute the hourly average. Subsequently, daily readings were computed, followed by aggregation into monthly and finally, yearly summaries.
Similar average values were computed for parameters such as the temperature, pressure and % CH_4.

Quality Assurance and Quality Control (QA & QC)

Documented Procedures and QA/QC Measures

QA/QC was applied throughout the monitoring period:

- Daily inspection of LFG extraction, flaring and monitoring systems;
- Checking and counter-signing of data forms by the CDM Manager;
- Data security (restricted access, password control) was applied to ensure the integrity of data;
- Inspection, observations, incidents and follow-up actions were documented;
- Independent audits were carried out by external consultants; and
- Data was analysed on a weekly basis to determine any irregularities.

Data Management and Storage

A proper data back-up system has been set up to ensure that the data will not be compromised in case of any unforeseen incidents at site resulting in total loss of data. The retention/archiving period for verification and CER issuance documents should be kept in electronic form for at least 2 years after the crediting period.

Continuous Monitoring (data logging system)

The data from continuous monitoring (data logger) was primarily stored in the hard disk located in the flare control room. To ensure that all data recorded are safe and properly archived, the following back-up system was applied for this project:

Types of back-up	Frequency	Back-up location
Manual back-up using a portable hard disk (HD)	Monthly	At the flare
Automatic back-up to the CDM Manager's PC located at the site office, BTSL	Weekly	On-site (site office)
Data server in the CDM Consultant's office (Eco-Ideal Consulting Sdn. Bhd., Unit C10-4, Tower C, Wisma Goshen, Bangsar Trade Centre, Kuala Lumpur, Malaysia)	Weekly	Off-site (consultant's office)

The data stored in the data server located at the CDM Consultant's office will be used as the primary back-up data in case of any emergency situation resulting in the loss of data from the flare data recording system. The automatic data back-up system based on internet data transmission can be illustrated as follows:

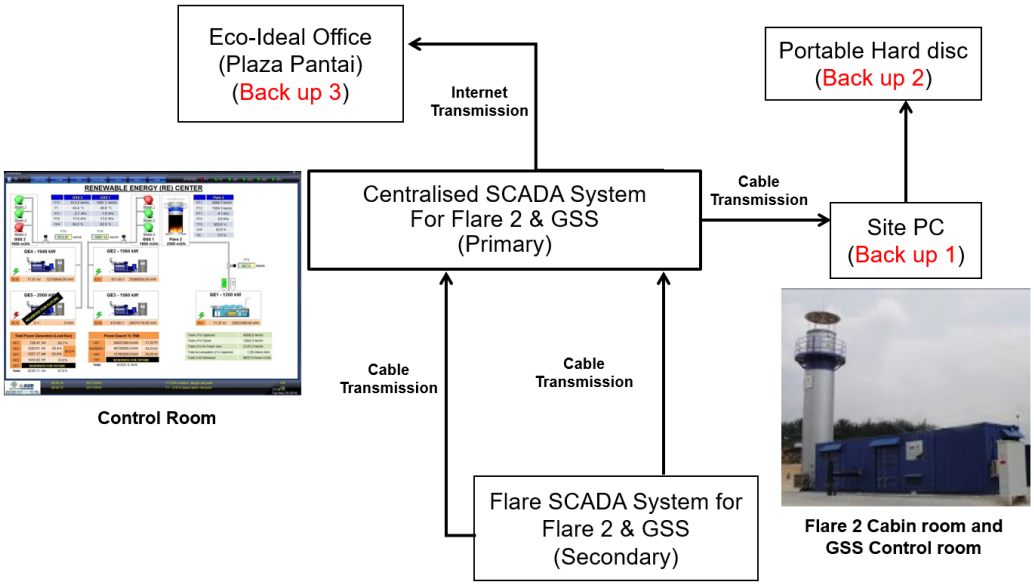


Figure 11: Automatic Data Back-Up for Flaring System at BTSL

Manual Recording

Daily operational data (consisting of CDM parameters monitored) recorded manually was backed-up by scanning all the daily monitoring log sheets on a weekly basis. These data were primarily stored in the computer at the cabin office next to the flare cabin. A copy of these scanned log sheets was handed to the CDM Consultant on a monthly basis for secondary back-up.

Training

Training is important to ensure that all the involved staff is provided with the needed knowledge and skills to undertake their roles effectively according to the CDM MP.

The staff has also attended several technical/operational trainings as listed below:

No.	Description	Date	No. of participants
1	Landfill Gas – GDU Operation Condensate Pump	07/03/2019	4
2	Landfill Gas SCADA System Data Log	08/05/2019	5
3	Daily Manual Log Sheet Form	14/08/2019	4

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

ACM0001: "Flaring or use of landfill gas" (Version 18.0)

Data / Parameter	**OX_{top_layer}**
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in the methodological tool "Emissions from solid waste disposal sites"
Value(s) applied)	0.1
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

Data / Parameter	**GWP_{CH4}**
Unit	tCO_2e/tCH_4
Description	Global Warming Potential (GWP) for CH_4
Source of data	IPCC
Value(s) applied)	25
Choice of data or measurement methods and procedures	Shall be updated according to any future COP/MOP decisions
Purpose of data	Baseline emissions calculation
Additional comment	25 for the second commitment period. Shall be updated according to any future COP/MOP decisions

Data / Parameter	**η_{PJ}**
Unit	Dimensionless
Description	Efficiency of the LFG capture system that will be installed in the project activity
Source of data	-
Value(s) applied)	90%
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	Technical specification of the LFG capture system to be installed (if available) or a default value of 90%

Data / Parameter	$\varphi_{default}$
Unit	-
Description	Default value for the model correction factor to account for model uncertainties
Source of data	-
Value(s) applied)	0.75
Choice of data or measurement methods and procedures	-
Purpose of da	Baseline emissions calculation
Additional comment	$\Phi_y = \varphi_{default}$. 0.75 for Application A, humid/wet conditions

Data / Parameter	**OX**
Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Based on an extensive review of published literature on this subject, including the "IPCC 2006 Guidelines for National Greenhouse Gas Inventories"
Value(s) applied)	0.1
Choice of data or measurement methods and procedures	-
Purpose of data:	Baseline emission calculation
Additional comment:	-

Data / Parameter	**F**
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied)	0.5
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

Data / Parameter	$DOC_{f,default}$
Unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied)	0.5
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	$DOC_{f,y} = DOC_{f,default}$

Data / Parameter	$MCF_{default}$
Unit	-
Description	Methane Correction Factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied)	1.0
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	$MCF_y = MCF_{default}$.

Data / Parameter	DOC_j
Unit	-
Description	Fraction of degradable organic carbon in the waste type *j* (weight fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 2.4 and 2.5)
Value(s) applied)	The following values for the different waste types *j* are applied:
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

Waste type *j*	DOC_j (% wet basis)
Wood and wood products	43
Pulp, paper and cardboard (other than sludge)	40
Food, food waste, beverages and tobacco (other than sludge)	15
Textiles	24
Garden, yard and park waste	20
Glass, plastic, metal, other inert waste	0

<table>
<tr><td>Data / Parameter</td><td>kj</td></tr>
<tr><td>Unit</td><td>1/yr</td></tr>
<tr><td>Description</td><td>Decay rate for the waste type j</td></tr>
<tr><td>Source of data</td><td>IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)</td></tr>
<tr><td>Value(s) applied)</td><td>The following values for the different waste types j is applied:

Default values for k_j
<table>
<tr><th colspan="2" rowspan="2">Waste type j</th><th>Tropical (MAT > 20°C)</th></tr>
<tr><th>Wet (MAP > 1,000 mm)</th></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textiles</td><td>0.07</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.035</td></tr>
<tr><td>Moderately degrading</td><td>Other (non-food) organic putrescible garden and park waste</td><td>0.17</td></tr>
<tr><td>Rapidly degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.40</td></tr>
</table>
Note: MAT – mean annual temperature, MAP – mean annual precipitation, PET – potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration.</td></tr>
<tr><td>Choice of data or measurement methods and procedures</td><td>-</td></tr>
<tr><td>Purpose of data</td><td>Baseline emissions calculation</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

“Project emissions from flaring” (Version 02.0.0)

Data / Parameter	**$SPEC_{flare}$**
Unit	Temperature - °C Flow rate or heat flux – kg/h or m^3/h
Description	Manufacturer’s flare specifications for temperature and flow rate and maintenance schedule
Source of data	Flare manufacturer
Value(s) applied)	Minimum and maximum operating temperature = 0 to 1,200°C Minimum and maximum inlet flow rate = 0 – 2,500 Nm^3/h
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

"Baseline, project and/ or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 02.0)

Data / Parameter	**$TDL_{k,y}$**
Unit	-
Description	Average technical transmission and distribution losses for providing electricity to source *k* in year *y*
Source of data	Tenaga Nasional Berhad (TNB) Annual Report 2016[6] in page 61
Value(s) applied)	7.74%
Choice of data or measurement methods and procedures	Average calculated from year 2014 – 2016 2014 – 8.15% 2015 – 7.68% 2016 – 7.39%
Purpose of data	Project emissions calculation and baseline emissions
Additional comment	For the project emission calculation, TDL of 7.74% is applied from 2017 onwards. 7.74% is calculated from the average of TDL from year 2014 – 2016, the % of the average TDL calculated is higher if compare to TDL in year 2016. This can be concluded that the TDL 7.74% apply for project emission from 2017 onwards is considered conservative approach.

"Tool to calculate the emission factor for an electricity system" (Version 05.0)

Data / Parameter	**$EF_{grid,OM,y}$**
Unit	tCO_2/MWh
Description	Operating margin emission factor for the grid in year *y*
Source of data	2014 Grid connected baseline for Peninsular Malaysia by Green Tech Centre (GTC) CDM Secretariat
Value(s) applied)	0.6532
Choice of data or measurement methods and procedures	The $EF_{grid,OM,y}$ was calculated and published by Green Tech Centre (GTC) CDM Secretariat in 2014 using version 04.0 of the tool. For 2nd crediting period, the emission factor of 2014 is recalculated using W_{OM} = 0.25 according to the "Tool to calculate the emission factor for an electricity system", version 05.0, paragraph 84 (b).
Purpose of data	Calculation of Combined margin emissions factor $EF_{grid,CM,y}$
Additional comment	-

[6] https://www.tnb.com.my/assets/annual_report/TNB_Annual_Report_2016.pdf

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO_2/MWh
Description	Build margin emission factor for the grid in year *y*
Source of data	2014 Grid connected baseline for Peninsular Malaysia by Green Tech Centre (GTC) CDM Secretariat
Value(s) applied)	0.7350
Choice of data or measurement methods and procedures	The $EF_{grid,BM,y}$ was calculated and published by Green Tech Centre (GTC) CDM Secretariat in 2014 using version 04.0 of the tool. For 2nd crediting period, the emission factor of 2014 is recalculated using W_{BM} = 0.75 according to the "Tool to calculate the emission factor for an electricity system", version 05.0, paragraph 84 (b).
Purpose of data	Calculation of Combined margin emissions factor $EF_{grid,CM,y}$
Additional comment	-

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO_2/MWh
Description	Combined margin emission factor for the grid in year *y*
Source of data	2014 Grid connected baseline for Peninsular Malaysia by Green Tech Centre (GTC) CDM Secretariat
Value(s) applied)	0.7146
Choice of data or measurement methods and procedures	The EFgrid,CM,y is calculated using published data by Green Tech Centre (GTC) CDM Secretariat in 2014 using version 04.0 of the tool. For 2nd crediting period, the emission factor of 2014 is recalculated according to the "Tool to calculate the emission factor for an electricity system", version 05.0
Purpose of data	Baseline and project emissions calculation
Additional comment	-

"Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0)

Data / Parameter	**MM_{H2O}**
Unit	kg/kmol
Description	Molecular mass of H_2O
Source of data	Methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" *(Version 03.0)*
Value(s) applied)	18.0152
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

Data / Parameter	**R_U**
Unit	$Pa.m^3/kmol.K$
Description	Universal ideal gases constant
Source of data	Methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" *(Version 03.0)*
Value(s) applied)	8,314
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

Data / Parameter	**MM_{CO2}**
Unit	kg/kmol
Description	Molecular mass of greenhouse gas CO_2
Source of data	Methodological tool "Tool to determine the mass flow of a greenhousegas in a gaseous stream" *(Version 03.0)*
Value(s) applied)	44.01
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

Data / Parameter	MM_{CH4}
Unit	kg/kmol
Description	Molecular mass of CH_4
Source of data	Methodological tool “Tool to determine the mass flow of a greenhousegas in a gaseous stream” *(Version 03.0)*
Value(s) applied)	16.04
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

Data / Parameter	MM_{O2}
Unit	kg/kmol
Description	Molecular mass of gas O_2
Source of data	Methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” *(Version 03.0)*
Value(s) applied)	32.00
Choice of data or measurement methods and procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

D.2. Data and parameters monitored

ACM0001: "Flaring or use of landfill gas – Version 18.0"

Data/Parameter	Management of SWDS
Unit	-
Description	Management of SWDS
Measured/calculated/ default	-
Source of data	Different sources of data available: (a) Origin design of the landfill; (b) Technical specification for the management of the SWDS; or (c) Local or national regulations.
Value(s) of monitored parameter	Local or national regulations, the reporting is based on the environmental monitoring report submitted to Department of Environment
Monitoring equipment	-
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Refer to the original design of the landfill to monitor any practice to increase methane generation during the implementation of the project activity. Any change in the management of the SWDS after the implementation of the project activity will be justified by referring to technical or regulatory specifications.
QA/QC procedures	-
Purpose of data/parameter	-
Additional comments	-

Data / Parameter	$Op_{j,h}$
Unit	-
Description	Operation of the equipment that consumes the LFG
Measured/calculated/default	Measured
Source of data	Project participant
Value(s) of monitored parameter	On or Off for flare temperature and gas engine, refer to $T_{EG,m}$

Dates	Operating Time (Hr) for Flare No.2
01/01/2019 – 31/01/2019	736
01/02/2019 – 28/02/2019	664
01/03/2019 – 31/03/2019	686
01/04/2019 – 30/04/2019	676
01/05/2019 – 31/05/2019	332
01/06/2019 – 30/06/2019	0
01/07/2019 – 31/07/2019	0
01/08/2019 – 31/08/2019	0
01/09/2019 – 30/09/2019	0
01/10/2019 – 31/10/2019	492
01/11/2019 – 30/11/2019	719
01/12/2019 – 31/12/2019	271
01/01/2020 – 31/01/2020	240
Total	**4,815**

	<table><tr><th rowspan="2">Dates</th><th colspan="4">Operating Time (Hr) for Gas Engines</th></tr><tr><th>No.1</th><th>No.2</th><th>No.3</th><th>No.4</th></tr><tr><td>01/01/2019 – 31/01/2019</td><td>701</td><td>678</td><td>735</td><td>0</td></tr><tr><td>01/02/2019 – 28/02/2019</td><td>668</td><td>504</td><td>658</td><td>0</td></tr><tr><td>01/03/2019 – 31/03/2019</td><td>576</td><td>741</td><td>740</td><td>0</td></tr><tr><td>01/04/2019 – 30/04/2019</td><td>0</td><td>664</td><td>672</td><td>0</td></tr><tr><td>01/05/2019 – 31/05/2019</td><td>0</td><td>470</td><td>612</td><td>431</td></tr><tr><td>01/06/2019 – 30/06/2019</td><td>0</td><td>568</td><td>575</td><td>545</td></tr><tr><td>01/07/2019 – 31/07/2019</td><td>0</td><td>684</td><td>390</td><td>0</td></tr><tr><td>01/08/2019 – 31/08/2019</td><td>10</td><td>609</td><td>616</td><td>255</td></tr><tr><td>01/09/2019 – 30/09/2019</td><td>695</td><td>236</td><td>453</td><td>78</td></tr><tr><td>01/10/2019 – 31/10/2019</td><td>738</td><td>336</td><td>727</td><td>0</td></tr><tr><td>01/11/2019 – 30/11/2019</td><td>705</td><td>482</td><td>661</td><td>0</td></tr><tr><td>01/12/2019 – 31/12/2019</td><td>331</td><td>655</td><td>676</td><td>0</td></tr><tr><td>01/01/2020 – 31/01/2020</td><td>648</td><td>719</td><td>730</td><td>0</td></tr><tr><td>Total</td><td>5,072</td><td>7,344</td><td>8,242</td><td>1,310</td></tr></table> Although GE4 is running 1,310 hour during this monitoring period, however, the power generation from GE4 is considered zero during this monitoring period due to module faulty, major overhaul, electrical and upgrading works and monitoring procedure as per monitoring plan stated in PDD version 20.5, where the lower value between internal and external meter is taken for calculation. As there is no meter reading from external meter are available for GE4, therefore, according to the PDD version 20.5, the lower value which is 0 is applied in the calculation.
Monitoring equipment	-
Measuring/reading/recording frequency	Hourly
Calculation method (if applicable)	For each equipment unit using the LFG monitor that the plant is operating in hour h by the monitoring any one or more of the following three parameters: • Temperature – Determine the location for temperature measurements and minimum operational temperature based on manufacturer's specifications of the burning equipment. Document and justify the location and minimum threshold in the PDD; • Flame – Flame detection system is used to ensure that the equipment is in operation; • Products generated. Monitor the generation of steam for the case of boilers and air-heaters and glass for the case of glass melting furnaces. This option is not applicable to brick kilns Flare temperature will be selected for the monitoring. Gas engine operation hour will be used for cross checking. Opj,h = 0 when: • One of more temperature measurements are missing or below the minimum threshold in hour h (instantaneous measurements are made at least every minute); or • Flame is not detected continuously in hour h (instantaneous measurements are made at least every minute). • No products are generated in the hour h. • If gas engine not in operation.

	Otherwise, Opj,h = 1.
QA/QC procedures	The operation of the equipment that consume the LFG will be monitored using temperature. The parameter will be measured continuously using temperature transmitter. The transmitter sensor is installed at the middle top of the enclosed flare stack. Minimum operational temperature in the exhaust gas of the enclosed flare is 500°C. The exhaust gas from the enclosed flares is expected to be in the range of 800-1,200°C. Temperatures above 500°C indicate that the flare is operated in a reliable way where the default value of destruction efficiency of 90% is valid. Temperature transmitter shall be tested, calibrated and maintained regularly. The detail information on the temperature is described under $\mathbf{T_{EG,m.}}$ The other method to cross check with the temperature is the operation of gas engines. The operating hour for gas engines is based on actual documented operating hours from site.
Purpose of data/parameter	Baseline emissions calculation
Additional comment	-

Data / Parameter	$\mathbf{EG_{PJ,y}}$ **(**$\mathbf{EL_{LFG,GE\ No.1,y,}}$ $\mathbf{EL_{LFG,GE\ No.2,y,}}$ $\mathbf{EL_{LFG,GE\ No.3,y,}}$ $\mathbf{EL_{LFG,GE\ No.4,y}}$**)**
Unit	MWh
Description	Amount of electricity generated using LFG by the project activity in year *y*
Measured/calculated/default	Measured
Source of data	Data as measured by electricity meters. This parameter was measured separately for the gas engines, i.e. Gas Engine No.1 (1 meter), Gas Engine No.2 and No.3 (1 meter) and Gas Engine No.4 (1 meter). Therefore, 3 sets of equipment have to be used for the monitoring period.
Value(s) of monitored parameter	There were 2 sets of power meters used to measure the amount of electricity sold to the grid, i.e. the main energy meter and check energy meter. Only the readings recorded by the main energy meter was used by the grid operator and the project participant in the calculation of CERs while the readings recorded by the check energy meter were only used to check or confirm on the readings recorded by the main energy meter. From the comparison of EL4 and EL5 (main meter), the lower value between the two is taken for the calculation of net amount of electricity generated for Gas Engine No.1. From the comparison of EL9 + EL10 and EL11 (main meter), the lower value between the two is taken for the calculation of net amount of electricity generated for Gas Engine No.2 and No.3. From the comparison of EL12 and EL13 (main meter), the lower value between the two is taken for the calculation of net amount of electricity generated for Gas Engine No.4. The detailed calculation was shown in the CER calculation sheet under each monthly 'EL_{PJ}' tab.

Dates	**Net electricity generated (MWh)** $\mathbf{EG_{PJ,y}}$	**Total amount**

	$EL_{LFG,GE\ No.1,y}$	$EL_{LFG,GE\ No.2,y}$ & $EL_{LFG,GE\ No.3,y}$	$EL_{LFG,GE\ No.4,y}$	of electricity generated (MWh)
01/01/2019 – 31/01/2019	460.50	1,369.45	0.00	1,829.95
01/02/2019 – 28/02/2019	531.35	1,260.18	0.00	1,791.53
01/03/2019 – 31/03/2019	470.41	1,549.39	0.00	2,019.80
01/04/2019 – 30/04/2019	0.00	1,447.51	0.00	1,447.51
01/05/2019 – 31/05/2019	0.00	1,112.92	0.00	1,112.92
01/06/2019 – 30/06/2019	0.00	964.50	0.00	964.50
01/07/2019 – 31/07/2019	0.00	930.00	0.00	930.00
01/08/2019 – 31/08/2019	7.09	972.29	0.00	979.38
01/09/2019 – 30/09/2019	379.53	564.67	0.00	944.21
01/10/2019 – 31/10/2019	542.55	1,222.74	0.00	1,765.28
01/11/2019 – 30/11/2019	518.68	1,097.40	0.00	1,616.08
01/12/2019 – 31/12/2019	232.04	1,383.40	0.00	1,615.44
01/01/2020 – 31/01/2020	443.84	1,440.16	0.00	1,884.01
Total	**3,585.99**	**15,314.62**	**0.00**	**18,900.61**

Power generation from GE4 is considered zero during this monitoring period due to module faulty, major overhaul, electrical and upgrading works and monitoring procedure as per monitoring plan stated in PDD version 20.5, where the lower value between internal and external meter is taken for calculation. As there is no meter reading from external meter are available for GE4, therefore, according to the PDD version 20.5, the lower value which is 0 is applied in the calculation.

Monitoring equipment

Item	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.1,y}$) Description (EL4)		$EG_{PJ,y}$ ($EL_{LFG,GE\ No.1,y}$) Description (EL5)	
	01/01/2019 – 13/03/2019	14/03/2019 – 31/01/2020	01/01/2019 – 31/01/2020	
			Main meter	Check meter
Type	EDMI Genius Power Meter		Itron (SL761A071) Power Meter	
Accuracy class	Class 0.5S		Class 0.20	
Serial No.	210225256		53099690	53099691
Calibration frequency	24 months		5 years	
Date of last calibration	06/01/2017	14/03/2019	01/04/2011	
Validity	24 months		5 years (Type 2 according to the Malaysian Grid Code, version 1/2010)	

EL4 (EDMI Genius Power, serial no.: 210225256) – Due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to EL4 from 06/01/2019 – 13/03/2019 as a conservative approach.

EL5 (Itron, serial no.: 53099690) – The meter is owned by the grid operator, TNB and thus, it is not within the control of the project owner. However, due to delay in calibration, the maximum permissible error of ±0.2% which is the equipment accuracy error was applied to EL5 from 01/01/2019 – 31/01/2020 as a conservative approach.

Item	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.2,y}$) Description (EL9)	$EG_{PJ,y}$ ($EL_{LFG,GE\ No.3,y}$) Description (EL10)
	01/01/2019 – 31/01/2020	01/01/2019 – 31/01/2020
Type	EDMI Limited (Genius) Power Meter	EDMI Limited (Genius) Power Meter
Accuracy class	Class 0.5S	Class 0.5S
Serial No.	211516862	211516863
Calibration frequency	24 months	24 months
Date of last calibration	25/01/2018	25/01/2018
Validity	24 months	24 months

EL9 and EL10 – Due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to EL9 and EL10 from 24/01/2020 – 31/01/2020 as a conservative approach.

Item	$EG_{PJ,y}$ ($EL_{LFG,y}$) Description (EL11)	
	01/01/2019 – 31/01/2020	
	Main energy meter	Check energy meter
Type	EDMI (Mk6E) Power Meter	
Accuracy class	Class 0.5S	
Serial No.	908705152	908705154

	<table><tr><td>Calibration frequency</td><td>5 years</td></tr><tr><td>Date of last calibration</td><td>06/12/2009</td></tr><tr><td>Validity</td><td>5 years (Type 2 according to the Malaysian Grid Code, version 1/2010)</td></tr></table> EL 11 (EDMI Limited, serial no.: 908705152) – The meter is owned by the grid operator, TNB and thus, it is not within the control of the project owner. However, due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to EL11 from 01/01/2019 – 31/01/2020 as a conservative approach. <table><tr><th rowspan="3">Item</th><th>$EG_{PJ,y}$ ($EL_{LFG,GE\ No.4,y}$) Description (EL12)</th><th colspan="2">$EG_{PJ,y}$ ($EL_{LFG,y}$) Description (EL13)</th></tr><tr><th rowspan="2">01/01/2019 – 31/01/2020</th><th colspan="2">01/01/2019 – 31/01/2020</th></tr><tr><th>Main energy meter</th><th>Check energy meter</th></tr><tr><td>Type</td><td>EDMI Limited (2000-6N00-30A31-04-L00-02A2-1D) Power Meter</td><td colspan="2">Itron (SL761W071) Power Meter</td></tr><tr><td>Accuracy class</td><td>Class 0.5S</td><td colspan="2">Class 0.2S</td></tr><tr><td>Serial No.</td><td>213545834</td><td>81480576</td><td>81480578</td></tr><tr><td>Calibration frequency</td><td>24 months</td><td colspan="2">5 years</td></tr><tr><td>Date of last calibration</td><td>08/08/2018</td><td colspan="2">14/06/2016</td></tr><tr><td>Validity</td><td>24 months</td><td colspan="2">5 years (Type 2 according to the Malaysian Grid Code, version 1/2010)</td></tr></table>
Measuring/reading/recording frequency	Measured continuously with electricity meter installed
Calculation method (if applicable)	N/A
QA/QC procedures	As a quality control procedure, the amount of electricity actually uploaded to grid will be measured by other electricity meters (EL5, EL11 and EL13) and compared with the net amount derived from above. Lower value of the amount will be taken as the net amount for emission reduction calculations. Electricity meters (except the meters owned by the grid operator, i.e. EL5, EL11 and EL13) will be checked and calibrated regularly according to manufacturer's recommendations. The meters EL5, EL11 and EL13 are owned by the grid operator and thus, they are not within the control of the project owner. The calibration of these meters will be based on the grid operator's requirement and standard practice.
Purpose of data/parameter	Baseline emissions calculation
Additional comment	-

Data / Parameter	**$EG_{EC,y}$**
Unit	MWh

<table>
<tr><td>Description</td><td>Amount of electricity consumed by the project activity in year y</td></tr>
<tr><td>Measured/calculated/default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Based on continuous measurement by sealed electricity meter installed.

The quantity of electricity consumed by project activity will be recorded by installed electricity meter EL6 which measured the total electricity consumed by the project activity (Flare 2, Gas Engine No.1, Gas Engine No.2, Gas Engine No.3, and Gas Engine No.4).

In case of temporary situation such as the installed electricity meter mal-functioned (EL6) leading to no readings captured, $EG_{EC,y}$ shall be estimated or calculated as described as below:

1. Using the backup meter EL1 which recorded the actual power consumption for Flare 2 and GSSF1;

2. For Gas Engine No. 2, Gas Engine No.3, and Gas Engine No.4 the power consumption will be estimated using the power rating (technical specifications) of the system involved during the power generation. The power consumed will be calculated based on the operating maximum capacity for the full period, including the 10% addition to account for transmission and distribution losses, according to PRC-2467-02.

In the case, temporary situation where EL1 malfunctions leading to no reading captured, the power consumption for Flare 1, Flare 2 and Gas Engine No.1 will be using the estimated historical data (September 2014 to August 2016) of 56.93 MWh and compared with the calculated future 24 months' data prior the malfunction period and, whichever higher will be applied for the project emission calculation. The higher power consumption selected for the project emission calculation shall be derived based on 95% confidence interval principles (source: "IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories", page 6.6). The upper bound of 95% confidence interval with reference to the above-mentioned guideline to be applied. Additional 10% will be added to the upper bound of the interval boundaries calculated to account for transmission and distribution losses, according to PRC-2467-02.</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th>Dates</th><th>Electricity consumed $EG_{EC,y}$ (EL6) (MWh)</th></tr>
<tr><td>01/01/2019 – 31/01/2019</td><td>147.21</td></tr>
<tr><td>01/02/2019 – 28/02/2019</td><td>149.10</td></tr>
<tr><td>01/03/2019 – 31/03/2019</td><td>158.53</td></tr>
<tr><td>01/04/2019 – 30/04/2019</td><td>110.32</td></tr>
<tr><td>01/05/2019 – 31/05/2019</td><td>185.98</td></tr>
<tr><td>01/06/2019 – 30/06/2019</td><td>222.47</td></tr>
<tr><td>01/07/2019 – 31/07/2019</td><td>219.80</td></tr>
<tr><td>01/08/2019 – 31/08/2019</td><td>227.06</td></tr>
<tr><td>01/09/2019 – 30/09/2019</td><td>238.70</td></tr>
<tr><td>01/10/2019 – 31/10/2019</td><td>230.49</td></tr>
<tr><td>01/11/2019 – 30/11/2019</td><td>233.55</td></tr>
<tr><td>01/12/2019 – 31/12/2019</td><td>207.97</td></tr>
<tr><td>01/01/2020 – 31/01/2020</td><td>235.01</td></tr>
<tr><td>Total</td><td>2,567.66</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th rowspan="2">Item</th><th>Electricity consumed from grid for project activity
$EG_{EC,y}$ ($EL_{PJ,y}$) (EL6) (MWh)</th></tr>
<tr><th>01/01/2019 – 31/01/2020</th></tr>
<tr><td>Type</td><td>IME NEMO 96HO+
Power Meter</td></tr>
<tr><td>Accuracy class</td><td>Class 1 (± 1%)</td></tr>
<tr><td>Serial No.</td><td>2661930098</td></tr>
<tr><td>Calibration frequency</td><td>36 months</td></tr>
<tr><td>Date of last calibration</td><td>25/01/2018</td></tr>
<tr><td>Validity</td><td>3 years according to manufacturer’s recommendation</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous measurement</td></tr>
<tr><td>Calculation method (if applicable)</td><td>N/A</td></tr>
<tr><td>QA/QC procedures</td><td>Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double-checked by the electricity distribution company</td></tr>
<tr><td>Purpose of data/parameter</td><td>Project emission calculation</td></tr>
<tr><td>Additional comment</td><td>This parameter is required for calculating project emissions from electricity consumption due to an alternative waste treatment process t ($PE_{EC,y}$) using the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”</td></tr>
</table>

"Emissions from solid waste disposal sites" (Version 08.0)

Data / Parameter	f_y
Unit	-
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y*
Measured/calculated/default	
Source of data	Onsite records of the gas analyzers.
Value(s) of monitored parameter	
Monitoring equipment	
Measuring/reading/recording frequency	For application A: Once for the crediting period ($f_y = f$)
Calculation method (if applicable)	N/A
QA/QC procedures	-
Purpose of data/parameter	Baseline emissions calculation
Additional comment	This is for reporting purposes, and not applied in the ER calculation

Dates	**Flare No.2 Value (%)**	**GSS1 Value (%)**	**GSS2 Value (%)**	**GSSF1 Value (%)**
01/01/2019 – 31/01/2019	0.59	0.55	0.00	0.58
01/02/2019 – 28/02/2019	0.59	0.56	0.00	0.58
01/03/2019 – 31/03/2019	0.58	0.55	0.00	0.58
01/04/2019 – 30/04/2019	0.60	0.59	0.00	0.00
01/05/2019 – 31/05/2019	0.57	0.57	0.61	0.00
01/06/2019 – 30/06/2019	0.00	0.58	0.60	0.00
01/07/2019 – 31/07/2019	0.00	0.58	0.00	0.00
01/08/2019 – 31/08/2019	0.00	0.56	0.60	0.52
01/09/2019 – 30/09/2019	0.00	0.53	0.59	0.53
01/10/2019 – 31/10/2019	0.61	0.57	0.00	0.62
01/11/2019 – 30/11/2019	0.60	0.63	0.00	0.63
01/12/2019 – 31/12/2019	0.60	0.65	0.00	0.62
01/01/2020 – 31/01/2020	0.60	0.63	0.00	0.63
Average	**0.59**	**0.58**	**0.60**	**0.59**

"Project emissions from flaring" (Version 03.0)

<table>
<tr><td>Data / Parameter</td><td>$T_{EG,m}$ ($T_{Flare,F2}$)</td></tr>
<tr><td>Unit</td><td>°C</td></tr>
<tr><td>Description</td><td>Temperature in the exhaust gas of the enclosed flare in minute m</td></tr>
<tr><td>Measured/calculated/default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Project participant</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th>Dates</th><th>$T_{EG,m}$ ($T_{Flare,F2}$) (°C)</th></tr>
<tr><td>01/01/2019 – 31/01/2019</td><td>574.17</td></tr>
<tr><td>01/02/2019 – 28/02/2019</td><td>587.27</td></tr>
<tr><td>01/03/2019 – 31/03/2019</td><td>587.67</td></tr>
<tr><td>01/04/2019 – 30/04/2019</td><td>662.06</td></tr>
<tr><td>01/05/2019 – 31/05/2019</td><td>568.08</td></tr>
<tr><td>01/06/2019 – 30/06/2019</td><td>0.00</td></tr>
<tr><td>01/07/2019 – 31/07/2019</td><td>0.00</td></tr>
<tr><td>01/08/2019 – 31/08/2019</td><td>0.00</td></tr>
<tr><td>01/09/2019 – 30/09/2019</td><td>0.00</td></tr>
<tr><td>01/10/2019 – 31/10/2019</td><td>712.72</td></tr>
<tr><td>01/11/2019 – 30/11/2019</td><td>761.83</td></tr>
<tr><td>01/12/2019 – 31/12/2019</td><td>767.89</td></tr>
<tr><td>01/01/2020 – 31/01/2020</td><td>719.31</td></tr>
<tr><td>Average</td><td>659.70</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th rowspan="2">Item</th><th colspan="2">$T_{EG,m}$ ($T_{Flare,F2}$) Description</th></tr>
<tr><th colspan="2">01/01/2019 – 31/01/2020</th></tr>
<tr><td>Type</td><td colspan="2">Honeywell (STT25M-0-EN0-000-000-000-00 3D) Temperature Transmitter</td></tr>
<tr><td>Accuracy class</td><td colspan="2">± 0.5% of span</td></tr>
<tr><td>Serial No.</td><td colspan="2">B838901937</td></tr>
<tr><td>Calibration frequency</td><td colspan="2">Annually</td></tr>
<tr><td>Date of last calibration</td><td>11/10/2018</td><td>18/09/2019</td></tr>
<tr><td>Validity</td><td colspan="2">1 year</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Once per minute</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Measure the temperature of the exhaust gas in the flare by an appropriate temperature measurement equipment.

The temperature of the exhaust gas in the flares is measured by temperature transmitters.

The exhaust gas from the enclosed flares is expected to be in the range of 800 – 1,200°C. Temperatures above 500°C indicate that the flare is operated in a reliable way where the default value of destruction efficiency of 90% is valid. Minimum operational temperature in the exhaust gas of the enclosed flare is 500°C.</td></tr>
<tr><td>QA/QC procedures</td><td>Temperature measurement equipment is calibrated in accordance with the maintenance schedule</td></tr>
<tr><td>Purpose of data/parameter</td><td>Baseline emissions calculation</td></tr>
</table>

Additional comment	Any unexpected changes such as a sudden increase/drop in temperature will be noted in the site records along with any corrective action that was implemented to correct the issue. Monitoring of this parameter is applicable in case of enclosed flares. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met

Data / Parameter	**$Flame_m$**
Unit	Flame on or Flame off
Description	Flame detection of flare in the minute *m*
Measured/calculated/default	Measured
Source of data	Project participant
Value(s) of monitored parameter	On or Off, refer to $\mathbf{V_{t,wb}}$
Monitoring equipment	Fixed installation optical flame detector: Ultra-violet detector
Measuring/reading/recording frequency	Once per minute. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off.
Calculation method (if applicable)	The flame detection will be monitored and cross checked with the amount of gas sent to flare (FT2) and gas engine (FT3). If there is data for FT2 and FT3, means the flame is on. Equipment will be maintained and calibrated in accordance with manufacturer's recommendations.
QA/QC procedures	Baseline emissions calculation
Purpose of data/parameter	Applicable to all flares
Additional comment	Once per minute. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off. For this monitoring period, the flame detection is monitored and cross checked with the amount of gas sent to flare (FT2).

"Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0)

Data / Parameter	**$V_{t,wb}$ ($LFG_{Flare,\ Flare\ No.2,y}$, $LFG_{electrcity,GSS1,y}$, $LFG_{electrcity,GSS2,y}$ $LFG_{electrcity,GSSF1,y}$)**
Unit	m^3 wet gas/h
Description	Volumetric flow of the gaseous stream in time interval *t* on a wet basis
Measured/calculated/default	Measured
Source of data	Onsite records of the flow meters. There is an independent flow meter to measure the gas sent to Flare No.2, ($FT2_{Flare\ No.2}$), GSS1 ($FT3_{GSS1}$), GSS2 ($FT3_{GSS2}$), and GSS F1 ($FT3_{GSSF1}$).
Value(s) of monitored parameter	***LGF_{total} - Total amount of LFG sent to flare/captured during the project at normal temperature and pressure:***

Flare No.2

According to ACM0001, version 18, page 15, if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational (e.g. by means of flame detector records, energy generated), a single flow meter may be used to record the flow into multiple destruction devices.

However, as Gas Engine No.1 was converted to GSSF1 which started to operate on 01/06/2017, only one flow meter (FT2) remained for Flare No. 2, therefore, no comparison was done started from June 17 onwards.

Dates	**$V_{t,wb}$ ($LFG_{Flare,Flare\ No.2,y}$) $FT_{2,\ Flare\ No.2}$ (Nm^3)**
01/01/2019 – 31/01/2019	718,441
01/02/2019 – 28/02/2019	597,968
01/03/2019 – 31/03/2019	506,362
01/04/2019 – 30/04/2019	487,052
01/05/2019 – 31/05/2019	297,772
01/06/2019 – 30/06/2019	0.00
01/07/2019 – 31/07/2019	0.00
01/08/2019 – 31/08/2019	0.00
01/09/2019 – 30/09/2019	0.00
01/10/2019 – 31/10/2019	474,082
01/11/2019 – 30/11/2019	508,054
01/12/2019 – 31/12/2019	189,712
01/01/2020 – 31/01/2020	138,881
Total	**3,972,438**

GSSF1 (Gas Engine No.1), GSS1 (Gas Engine No.2 and 3) and GSS2 (Gas Engine No.4)

According to ACM0001, version 18, page 15, if the LFG is used for multiple purposes (e.g. flaring or energy generation), and all methane destruction devices are verified to be operational (e.g. by means of flame detector records, energy generated), a single flow meter may be used to record the flow into multiple destruction devices. In the case where LFG is just sent to the power plants (gas engines) for electricity generation, one flow meter can be used provided that these meters used are calibrated periodically by an officially accredited entity. The total LFG captured was the same as the total LFG sent to the gas engines for GSS F1, GSS1 and GSS2 respectively during the monitoring period as total LFG captured in GSSF1 was only sent to Gas Engine No.1, total LFG captured in GSS1 was only sent to Gas

Engine No.2 and No.3, and total LFG captured in GSS2 was sent to Gas Engine No.4.

Dates	$V_{t, wb}$ ($LFG_{electrcity,GSS1,y}$) $FT_{3, GSS1}$ (Nm^3)	$V_{t, wb}$ ($LFG_{electrcity,GSS2,y}$) $FT_{3, GSS2}$ (Nm^3)	$V_{t, wb}$ ($LFG_{electrcity,GSSF1,y}$) $FT_{3, GSSF1}$ (Nm^3)
01/01/2019 – 31/01/2019	788,930	0.00	326,114
01/02/2019 – 28/02/2019	710,791	0.00	379,308
01/03/2019 – 31/03/2019	883,853	0.00	325,516
01/04/2019 – 30/04/2019	826,640	0.00	0.00
01/05/2019 – 31/05/2019	628,374	420,691	0.00
01/06/2019 – 30/06/2019	532,856	574,204	0.00
01/07/2019 – 31/07/2019	557,502	0.00	0.00
01/08/2019 – 31/08/2019	638,371	166,382	3,231
01/09/2019 – 30/09/2019	378,915	40,913	311,137
01/10/2019 – 31/10/2019	220,000	0.00	391,404
01/11/2019 – 30/11/2019	670,993	0.00	386,524
01/12/2019 – 31/12/2019	825,254	0.00	177,655
01/01/2020 – 31/01/2020	804,444	0.00	321,219
Total	**8,466,922**	**1,202,190**	**2,622,107**

Monitoring equipment

Item	**Flare No.2, $LFG_{flare,Flare\ No.2,y}$ ($FT_{1, Flare\ No.2}$)**
	01/01/2019 – 31/01/2020
Type	Flow transmitter – Rosemount Differential Pressure Transmitter – Kingways Control Vcone
Accuracy class	± 1%
Serial No.	4972946 (Rosemount) / FT119 (8102101) (Kingways)
Calibration frequency	24 months
Date of last calibration	04/06/2018
Validity	24 months

Item	**Flare No.2, $LFG_{flare,Flare\ No.2,y}$ ($FT_{2, Flare\ No.2}$)**
	01/01/2019 – 31/01/2020
Type	Flow transmitter – Rosemount Differential Pressure Transmitter – Kingways Control Vcone
Accuracy class	± 0.5%
Serial No.	5476627 (Rosemount) / FT140 (10031701) (Kingways)
Calibration frequency	24 months
Date of last calibration	04/06/2018
Validity	24 months

Item	**GSS1, $LFG_{electricity,GSS1,y}$ ($FT_{3, GSS1}$)**

	01/01/2019 – 31/01/2020
Type	Flow transmitter – Rosemount
Accuracy class	± 0.5%
Serial No.	5988022
Calibration frequency	24 months
Date of last calibration	11/10/2018
Validity	24 months

Item	GSS2, $LFG_{electricity,GSS2,y}$ ($FT_{3, GSS2}$)
	01/01/2019 – 31/01/2020
Type	Flow transmitter – Binder
Accuracy class	± 2.5% of reading + 0.2% of full scale
Serial No.	C150327
Calibration frequency	24 months
Date of last calibration	10/12/2018
Validity	24 months

Item	GSSF1, $LFG_{electricity,GSSF1,y}$ ($FT_{3, GSSF1}$)	
	01/01/2019 – 31/01/2020	
Type	Flow transmitter – Rosemount Differential Pressure Transmitter – Kingways Control Vcone	
Accuracy class	± 0.5%	
Serial No.	02768007 (Rosemount) / FT161 (11011001) (Kingways)	
Calibration frequency	24 months	
Date of last calibration	05/01/2017	18/09/2019
Validity	24 months	

GSSF1 (Gas Engine No.1)

FT3 – Due to delay in calibration, the maximum permissible error of ±0.5% which is the equipment accuracy error was applied to FT3 from 04/01/2019 – 17/09/2019 as a conservative approach.

Measuring/reading/recording frequency	Continuous if not specified in the underlying methodology/tool
Calculation method (if applicable)	-
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory for all projects applying large scale methodology (ies). Calibration and frequency of calibration is according to manufacturer's specifications
Purpose of data/parameter	Baseline emissions calculation
Additional comment	This parameter is monitored in Option B

<table>
<tr><td>Data / Parameter</td><td>$V_{CH4,m,db}$ ($W_{CH4,Flare\ No.2,y}$, $W_{CH4,GSS1,y}$, $W_{CH4,GSS2,y}$, $W_{CH4,GSSF1,y}$)</td></tr>
<tr><td>Unit</td><td>m^3 CH_4 / m^3 dry gas</td></tr>
<tr><td>Description</td><td>Volumetric fraction of greenhouse gas CH_4 in minute m on a dry basis</td></tr>
<tr><td>Measured/calculated/default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Onsite records of the gas analyzers.

In case of temporary situation such as the installed CH_4 gas analyser mal-functioned or giving unrepresentative results due to data logging problem, the V_{CH4} shall be measured manually with portable gas analyser. For any affected day, the calculation of the values measured using the portable analyser will be based on the Guidelines to calculate the fraction of methane in the landfill gas from periodical measurements (Version 01). As conservative approach, the lower bound of the 95% Confidence Interval will be applied as per guideline.</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th rowspan="2">Dates</th><th colspan="4">Methane Fraction of LFG (%), $V_{CH4,m,db}$</th></tr>
<tr><th>Flare No.2, $W_{CH4,Flare\ No.2,y}$</th><th>GSS1, $W_{CH4,GSS1,y}$</th><th>GSS2, $W_{CH4,GSS2,y}$</th><th>GSSF1, $W_{CH4,GSSF1,y}$</th></tr>
<tr><td>01/01/2019 – 31/01/2019</td><td>0.59</td><td>0.55</td><td>0.00</td><td>0.58</td></tr>
<tr><td>01/02/2019 – 28/02/2019</td><td>0.59</td><td>0.56</td><td>0.00</td><td>0.58</td></tr>
<tr><td>01/03/2019 – 31/03/2019</td><td>0.58</td><td>0.55</td><td>0.00</td><td>0.58</td></tr>
<tr><td>01/04/2019 – 30/04/2019</td><td>0.60</td><td>0.59</td><td>0.00</td><td>0.00</td></tr>
<tr><td>01/05/2019 – 31/05/2019</td><td>0.57</td><td>0.57</td><td>0.61</td><td>0.00</td></tr>
<tr><td>01/06/2019 – 30/06/2019</td><td>0.00</td><td>0.58</td><td>0.60</td><td>0.00</td></tr>
<tr><td>01/07/2019 – 31/07/2019</td><td>0.00</td><td>0.58</td><td>0.00</td><td>0.00</td></tr>
<tr><td>01/08/2019 – 31/08/2019</td><td>0.00</td><td>0.56</td><td>0.60</td><td>0.52</td></tr>
<tr><td>01/09/2019 – 30/09/2019</td><td>0.00</td><td>0.53</td><td>0.59</td><td>0.53</td></tr>
<tr><td>01/10/2019 – 31/10/2019</td><td>0.61</td><td>0.57</td><td>0.00</td><td>0.62</td></tr>
<tr><td>01/11/2019 – 30/11/2019</td><td>0.60</td><td>0.63</td><td>0.00</td><td>0.63</td></tr>
<tr><td>01/12/2019 – 31/12/2019</td><td>0.60</td><td>0.65</td><td>0.00</td><td>0.62</td></tr>
<tr><td>01/01/2020 – 31/01/2020</td><td>0.60</td><td>0.63</td><td>0.00</td><td>0.63</td></tr>
<tr><td>Average</td><td>0.59</td><td>0.58</td><td>0.60</td><td>0.59</td></tr>
</table>

<u>GSSF1</u>
CH4 – Portable CH4 analyser was used for the period from 01/01/2019 to 12/09/2019, the detail of measurement method refers to section D.3.</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><th rowspan="2">Item</th><th colspan="2">Flare No.2, $W_{CH4,Flare\ No.2,y}$ ($CH_{4,\ Flare\ No.2}$)</th></tr>
<tr><th>01/01/2019 – 17/09/2019</th><th>18/09/2019-31/01/2020</th></tr>
<tr><td>Type</td><td colspan="2">Guardian Plus (97460) Infra-Red Gas Monitor</td></tr>
<tr><td>Accuracy class</td><td colspan="2">± 2%</td></tr>
<tr><td>Serial No.</td><td>31453</td><td>33542</td></tr>
<tr><td>Calibration frequency</td><td colspan="2">Annually</td></tr>
<tr><td>Date of last</td><td>04/06/2018</td><td>18/09/2019</td></tr>
</table>
</td></tr>
</table>

calibration		
Validity	1 year	

Flare 2

CH4 – Due to delay in calibration, the maximum permissible error of which is the equipment accuracy error was applied to CH4 from 03/06/2019 – 17/09/2019 as a conservative approach.

Item	GSS1, $W_{CH4,GSS1,y}$ ($CH_{4,GSS1}$)	
	01/01/2019 – 25/07/2019	26/07/2019 – 31/01/2020
Type	Edinburgh Guardian Ng	Guardian Plus (97460) Infra-Red Gas Monitor
Accuracy class	± 2%	
Serial No.	14464	33436
Calibration frequency	Annually	
Date of last calibration	27/12/2018	26/07/2019
Validity	1 year	

Item	GSS2, $W_{CH4,GSS2,y}$ ($CH_{4,GSS2}$)	
	01/01/2019 – 12/09/2019	13/09/2019 – 31/01/2020
Type	Guardian Plus (97460)	Edinburgh Guardian Ng
Accuracy class	± 2%	± 2%
Serial No.	33542	14464
Calibration frequency	Annually	Annually
Date of last calibration	11/10/2018	27/12/2018
Validity	1 year	1 year

GSS2

CH_4 – Due to delay in calibration, the maximum permissible error of which is the equipment accuracy error was applied to CH_4 from 26/12/2019 – 31/01/2020 as a conservative approach.

Item	GSSF1, $W_{CH4,GSSF1,y}$ ($CH_{4,GSSF1}$)	
	01/01/2019 – 12/09/2019	13/09/2019 – 31/01/2020
Type	Geotech (GA5000)	Cubic-Ruiyi
Accuracy class	± 1.5%	± 1.0%
Serial No.	G505823	21905310261000000001
Calibration frequency	Annually	Annually
Date of last calibration	25/10/2018	05/06/2019
Validity	1 year	1 year

GSSF1

CH4 – Portable CH4 analyser was used for the period from 01/01/2019 to 12/09/2019, the detail of measurement method refers to section D.3.

Measuring/reading/recording frequency	The CH_4 fraction were measured continuously with certified equipment or measured manually with a portable gas analyser during emergency cases

Calculation method (if applicable)	Raw data logged at 1 minute's interval was used to compute the daily average readings
QA/QC procedures	The CH_4 gas analyser was checked and calibrated regularly according to the manual given by the manufacturer
Purpose of data/parameter	Baseline emission calculation
Additional comment	-

Data / Parameter	**T_t ($T_{TT1,F2}$, $T_{TT1,GSS1}$, $T_{TT1,GSS2}$, $T_{TT1,GSSF1}$)**
Unit	°C
Description	Temperature of the gaseous stream in time interval *t*
Measured/calculated/default	Measured
Source of data	Continuous measurement by temperature meter. This parameter was measured separately for both flare and the gas engines, i.e. Flare No.2 (1 meter), Gas Engine No.1 (1 meter), Gas Engine No.2 and No.3 (1 meter) and Gas Engine No.4 (1 meter). Therefore, 4 sets of equipment have to be used for the monitoring period.

Value(s) of monitored parameter

Dates	**T_t (°C)**			
	$T_{TT1,F2}$	**$T_{TT1,GSS1}$**	**$T_{TT1,GSS2}$**	**$T_{TT1,GSSF1}$**
01/01/2019 – 31/01/2019	40.48	48.61	0.00	45.92
01/02/2019 – 28/02/2019	41.89	49.14	0.00	46.63
01/03/2019 – 31/03/2019	37.93	49.99	0.00	46.64
01/04/2019 – 30/04/2019	37.68	48.27	0.00	0.00
01/05/2019 – 31/05/2019	41.04	47.62	41.26	0.00
01/06/2019 – 30/06/2019	0.00	46.86	43.02	0.00
01/07/2019 – 31/07/2019	0.00	47.06	0.00	0.00
01/08/2019 – 31/08/2019	0.00	41.79	43.01	39.85
01/09/2019 – 30/09/2019	0.00	39.02	40.27	44.77
01/10/2019 – 31/10/2019	34.48	38.08	0.00	45.08
01/11/2019 – 30/11/2019	33.98	39.76	0.00	46.07
01/12/2019 – 31/12/2019	34.97	43.38	0.00	44.29
01/01/2020 – 31/01/2020	34.22	45.22	0.00	45.66
Average	**37.41**	**44.98**	**41.89**	**44.99**

Monitoring equipment

Item	**Flare No.2, T_t ($T_{TT1,F2}$)**	
	01/01/2019 -31/01/2020	
Type	Honeywell (STT25M-0-EN0-000-000-000-00-3D) Temperature Transmitter	
Accuracy class	± 0.5% of span	
Serial No.	B839917437	
Calibration frequency	Annually	
Date of last calibration	11/10/2018	18/09/2019
Validity	1 year	

Item	**GSS1, T_t ($T_{TT1,GSS1}$)**
	01/01/2019 -31/01/2020
Type	Honeywell (STT25M-0-ENS-000-000-000-00-3H) Temperature Transmitter
Accuracy class	± 1%
Serial No.	B527143837

	<table><tr><td>Calibration frequency</td><td colspan="2">Annually</td></tr><tr><td>Date of last calibration</td><td>11/10/2018</td><td>18/09/2019</td></tr><tr><td>Validity</td><td colspan="2">1 year</td></tr></table> <table><tr><th rowspan="2">Item</th><th colspan="2">GSS2, T_t ($T_{TT1,GSS2}$)</th></tr><tr><th colspan="2">01/01/2019 -31/01/2020</th></tr><tr><td>Type</td><td colspan="2">Autrol (ATT2100-S11HA3E1-M1) Temperature Transmitter</td></tr><tr><td>Accuracy class</td><td colspan="2">± 0.1%</td></tr><tr><td>Serial No.</td><td colspan="2">ATT21004151000</td></tr><tr><td>Calibration frequency</td><td colspan="2">Annually</td></tr><tr><td>Date of last calibration</td><td>04/06/2018</td><td>18/09/2019</td></tr><tr><td>Validity</td><td colspan="2">1 year</td></tr></table> **GSS2 (Gas Engine No. 4)** TT1 - Due to delay in calibration, the maximum permissible error of ±0.1% which is the equipment accuracy error was applied to TT1 from 03/06/2019 – 17/09/2019 as a conservative approach. The impact of applying this error to the flow normalisation is negligible. <table><tr><th rowspan="2">Item</th><th colspan="2">GSSF1, T_t ($T_{TT1,GSSF1}$)</th></tr><tr><th colspan="2">01/01/2019 -31/01/2020</th></tr><tr><td>Type</td><td colspan="2">PR Electronics (5335A) Temperature Transmitter</td></tr><tr><td>Accuracy class</td><td colspan="2">≤ ± 0.05% of span</td></tr><tr><td>Serial No.</td><td colspan="2">100944768</td></tr><tr><td>Calibration frequency</td><td colspan="2">Annually</td></tr><tr><td>Date of last calibration</td><td>04/06/2018</td><td>18/09/2019</td></tr><tr><td>Validity</td><td colspan="2">1 year</td></tr></table> **GSSF1 (Gas Engine No. 1)** TT1 - Due to delay in calibration, the maximum permissible error of ±0.05% which is the equipment accuracy error was applied to TT1 from 03/06/2019 – 17/09/2019 as a conservative approach.
Measuring/reading/recording frequency	Measured continuously by temperature meter
Calculation method (if applicable)	Raw data logged at 1 minute's interval was used to compute the daily average readings
QA/QC procedures	The temperature transmitter was calibrated regularly according to the manual given by the manufacturer
Purpose of data/parameter	Baseline emission calculation
Additional comment	-

Data / Parameter	**P_t ($P_{PT2,F2}$, $P_{PT2,GSS1}$, $P_{PT2,GSS2}$, $P_{PT2,GSSF1}$)**
Unit	kPa
Description	Pressure of the gaseous stream in time interval *t*
Measured/calculated/default	Measured

Source of data

Continuous measurement by pressure transmitter.

This parameter was measured separately for both flares and the gas engines, i.e. Flare No.2 (1 meter), Gas Engine No.1 (1 meter), Gas Engine No.2 and No.3 (1 meter) and Gas Engine No.4 (1 meter). Therefore, 4 sets of equipment have to be used for the monitoring period.

Value(s) of monitored parameter

Average Gauge Pressure (Dates)	P_t (kPa)			
	$PT_{PT2,F2}$	$PT_{PT2,GSS1}$	$PT_{PT2,GSS2}$	$PT_{PT2,GSSF1}$
01/01/2019 – 31/01/2019	9.60	16.99	0.00	18.35
01/02/2019 – 28/02/2019	8.43	17.00	0.00	18.96
01/03/2019 – 31/03/2019	4.38	16.99	0.00	18.97
01/04/2019 – 30/04/2019	5.03	16.22	0.00	0.00
01/05/2019 – 31/05/2019	8.45	16.32	14.24	0.00
01/06/2019 – 30/06/2019	0.00	16.47	16.72	0.00
01/07/2019 – 31/07/2019	0.00	16.72	0.00	0.00
01/08/2019 – 31/08/2019	0.00	16.26	15.88	10.06
01/09/2019 – 30/09/2019	0.00	16.64	14.78	16.32
01/10/2019 – 31/10/2019	1.89	16.51	0.00	17.56
01/11/2019 – 30/11/2019	1.24	17.05	0.00	17.79
01/12/2019 – 31/12/2019	0.86	16.81	0.00	15.98
01/01/2020 – 31/01/2020	0.49	17.66	0.00	16.52
Average	**4.49**	**16.74**	**15.40**	**16.72**

Average Absolute Pressure (Dates)	P_t (kPa)			
	$PT_{PT2,F2}$	$PT_{PT2,GSS1}$	$PT_{PT2,GSS2}$	$PT_{PT2,GSSF1}$
01/01/2019 – 31/01/2019	110.93	118.32	101.33	119.67
01/02/2019 – 28/02/2019	109.76	118.32	101.33	120.29
01/03/2019 – 31/03/2019	105.71	118.31	101.33	120.30
01/04/2019 – 30/04/2019	106.36	117.55	101.33	101.33
01/05/2019 – 31/05/2019	109.78	117.64	115.57	101.33
01/06/2019 – 30/06/2019	101.33	117.80	118.05	101.33
01/07/2019 – 31/07/2019	101.33	118.04	101.33	101.33
01/08/2019 – 31/08/2019	101.33	117.59	117.20	111.39
01/09/2019 – 30/09/2019	101.33	117.97	116.10	117.64
01/10/2019 – 31/10/2019	103.21	117.83	101.33	118.89
01/11/2019 – 30/11/2019	102.57	118.37	101.33	119.12
01/12/2019 – 31/12/2019	102.18	118.13	101.33	117.30
01/01/2020 – 31/01/2020	101.81	118.99	101.33	117.85
Average	**104.43**	**118.07**	**106.06**	**112.90**

Some of the absolute pressure reading is constant at 101.33, for example Flare 2, it occurred during the month from 01/06/2019 to 30/09/2019, this is due to the shutdown of Flare No. 2, there was no result for PT2. The absolute pressure reading is 101.33.

Referring to the Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 2.0), page 11, pressure at normal conditions is 101,325 Pa. The values of the absolute pressure are calculated by adding the ambient pressure at normal conditions to the gauge pressure.

Monitoring equipment

Item	Flare No.2, P_t ($PT_{PT2,F2}$)	
	01/01/2019 – 17/09/2019	18/09/2019 – 31/01/2010
Type	Rosemount (3051TG1A2B21AB4E5Q4) Pressure Transmitter	Rosemount (3051TG1A2B21AB4K5M5)
Accuracy class	± 0.25%	± 0.1%
Serial No.	5584784	5916057
Calibration frequency	Annually	
Date of last calibration	11/10/2018	18/09/2019
Validity	1 year	

Item	GSS1, P_t ($PT_{PT2,GSS1}$)	
	01/01/2019 – 17/09/2019	18/09/2019 - 31/01/2020
Type	Rosemount (3051TG1A2B21AB4K5M5) Pressure Transmitter	Rosemount (3051TG1A2B21AB4E5Q4) Pressure Transmitter
Accuracy class	± 0.1%	± 0.25%
Serial No.	5916057	5584784
Calibration frequency	Annually	
Date of last calibration	11/10/2018	11/10/2018
Validity	1 year	

GSS1 (Gas Engine No. 2 & No.3)

PT2 - Due to delay in calibration, the maximum permissible error of ±0.25% which is the equipment accuracy error was applied to PT2 from 10/10/2019 – 31/01/2020 as a conservative approach. The impact of applying this error to the flow normalisation is negligible.

Item	GSS2, P_t ($PT_{PT2,GSS2}$)	
	01/01/2019 – 31/01/2020	
Type	Autrol (APT3200-G4M11E11S1-M1) Pressure Transmitter	
Accuracy class	± 0.075% of span	
Serial No.	APT3200-4150998	
Calibration frequency	Annually	
Date of last calibration	04/06/2018	18/09/2019
Validity	1 year	

GSS2 (Gas Engine No. 4)

PT2 - Due to delay in calibration, the maximum permissible error of ±0.075% which is the equipment accuracy error was applied to PT2 from 03/06/2019 – 17/09/2019 as a conservative approach. The impact of applying this error to the flow normalisation is negligible.

	<table><tr><th>Item</th><th colspan="2">GSSF1, P_t ($PT_{PT2,GSSF1}$) 01/01/2019 – 31/01/2020</th></tr><tr><td>Type</td><td colspan="2">Rosemount (3051TG1A2B21AB4E5M5Q4) Pressure Transmitter</td></tr><tr><td>Accuracy class</td><td colspan="2">± 0.25%</td></tr><tr><td>Serial No.</td><td colspan="2">02492864</td></tr><tr><td>Calibration frequency</td><td colspan="2">Annually</td></tr><tr><td>Date of last calibration</td><td>04/06/2018</td><td>18/09/2019</td></tr><tr><td>Validity</td><td colspan="2">1 year</td></tr></table> **GSSF1 (Gas Engine No. 1)** PT2 - Due to delay in calibration, the maximum permissible error of ±0.25% which is the equipment accuracy error was applied to PT2 from 03/06/2019 – 17/09/2019 as a conservative approach. The impact of applying this error to the flow normalisation is negligible.
Measuring/reading/recording frequency	Measured continuously by a pressure transmitter
Calculation method (if applicable)	Raw data logged at 1 minute's interval was used to compute the daily average readings
QA/QC procedures	The meter was checked and calibrated regularly according to the manual given by the manufacturer
Purpose of data/parameter	Baseline emission calculation
Additional comment	-

Data / Parameter	**$P_{H2O,t,Sat}$**
Unit	Pa
Description	Saturation pressure of H_2O at temperature T_t in time interval *t*
Measured/calculated/default	Calculated
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 03.0)
Value(s) of monitored parameter	**101,325 Pa**
Monitoring equipment	
Measuring/reading/recording frequency	-
Calculation method (if applicable)	This parameter is solely a function of a gaseous stream temperature T_t and can be found at reference [1] for a total pressure equal to 101,325 Pa
QA/QC procedures	-
Purpose of data/parameter	Baseline emissions calculation
Additional comment	[1] Fundamentals of Classical Thermodynamics; Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4º Edition 1994, John Wiley & Sons, Inc.

Data / Parameter	**$V_{CO2,t,db}$**
Unit	m^3 gas CO_2 / m^3 dry gas
Description	Volumetric fraction of greenhouse gas CO_2 in the gaseous stream in time interval *t* on a dry basis

Measured/calculated/default	Measured
Source of data	The V_{CO2} shall be measured manually with portable gas analyser. A minimum sampling frequency of one sample per week to be conducted. As conservative approach, the lower bound of the 95% Confidence Interval will be applied for the data collected.
Value(s) of monitored parameter	36.6%
Monitoring equipment	Portable gas analyser
Measuring/reading/recording frequency	Continuous if not specified in the underlying methodology/tool
Calculation method (if applicable)	Continuous gas analyser operating in dry-basis
QA/QC procedures	Calibration should include zero verification with an inert gas (e.g. N_2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period
Purpose of data/parameter	Baseline emissions calculation
Additional comment	-

Data / Parameter	**$V_{O2,t,db}$**
Unit	m^3 gas O_2 / m^3 dry gas
Description	Volumetric fraction of greenhouse gas O_2 in the gaseous stream in time interval *t* on a dry basis
Measured/calculated/default	Measured
Source of data	On site measurement
Value(s) of monitored parameter	1.25%
Monitoring equipment	Continuous gas analyser operating in dry-basis
Measuring/reading/recording frequency	Continuous if not specified in the underlying methodology/tool
Calculation method (if applicable)	-
QA/QC procedures	Calibration should include zero verification with an inert gas (e.g. N_2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period
Purpose of data/parameter	Baseline emissions calculation
Additional comment	-

Data / Parameter	**Status of biogas destruction device**
Unit	-
Description	Operational status of biogas destruction devices
Measured/calculated/default	Measured
Source of data	On-site measurement
Value(s) of monitored parameter	On or Off, refer to $V_{t,wb}$ and operating hour of Gas engines ($\mathbf{Op_{j,h}}$).
Monitoring equipment	Monitoring and documenting may be undertaken by recording the energy production from methane captured or the operation of the flare by means of a flame detector to demonstrate the actual destruction of methane, unless a different method is specified in the underlying methodology/tool. Emission reductions will not accrue for periods in which the destruction device is not operational
Measuring/reading/recording frequency	Continuous if not specified in the underlying methodology/tool
Calculation method (if applicable)	N/A
QA/QC procedures	The operational status will be monitored and cross checked with the amount of gas sent to flare (FT2), and also the operating hour for Gas Engines.
Purpose of data/parameter	Baseline emissions calculation
Additional comment	For flame detector devices, refer to the methodological tool “Project emissions from flaring”

"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 03.0)

Data / Parameter	**$FC_{i,j,y}$**
Unit	ton/yr
Description	Quantity of fuel type i combusted in process j during the year y
Measured/calculated/default	Measured
Source of data	Onsite measurements
Value(s) of monitored parameter	0.06
Monitoring equipment	Fuel meter
Measuring/reading/recording frequency	Continuously
Calculation method (if applicable)	The measurement from fuel meter is in litre, for the calculation, the amount of diesel in litre will be convert to tonne/year by multiply the density of diesel (kg/l)
QA/QC procedures	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records
Purpose of data/parameter	Project emissions calculation
Additional comment	-

Data / Parameter	**$EF_{CO2,i,y}$**
Unit	tCO_2/GJ
Description	Weighted average CO_2 emission factor of fuel type i in year y
Measured/calculated/default	Default (Option D was applied in the calculation)
Source of data	Option A will be used if the value is available from the fuel supplier in invoices; Option D will be used if there is no data available from the fuel supplier.
Value(s) of monitored parameter	0.0741
Monitoring equipment	-
Measuring/reading/recording frequency	If the values are provided by fuel supplier, the measurements should be undertaken in line with national or international fuel standards. If the value is according to IPCC default value, any future revision of the IPCC Guidelines should be taken into account.
Calculation method (if applicable)	For a): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated For d): Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures	-
Purpose of data/parameter	Project emissions calculation
Additional comment	-

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ/ton
Description	Weighted average net calorific value of fuel type i in year y
Measured/calculated/default	Default (Option D was applied in the calculation)
Source of data	Option A will be used if the value is available from the fuel supplier in invoices; Option D will be used if there is no data available from the fuel supplier.
Value(s) of monitored parameter	43
Monitoring equipment	-
Measuring/reading/recording frequency	For a): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated. For d): Any future revision of the IPCC Guidelines should be taken into account
Calculation method (if applicable)	For a): The NCV emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated. For d): Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures	If option A value is used for the calculation, verify if the values under a) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data/parameter	Project emissions calculation
Additional comment	-

D.3 Implementation of sampling plan

According to PDD version 20.5, the source of data for $v_{CH4,m,db}$ (Volumetric fraction of greenhouse gas CH4 in minute m on a dry basis), in case of temporary situation such as the installed CH_4 gas analyser mal-functioned or giving unrepresentative results due to data logging problem, the VCH_4 shall be measured manually with portable gas analyser. For any affected day, the calculation of the values measured using the portable analyser will be based on the Guidelines to calculate the fraction of methane in the landfill gas from periodical measurements (Version 01). As conservative approach, the lower bound of the 95% Confidence Interval will be applied as per guideline.

Sample Design

The sample design for the manual measurement using portable gas analyser is according to Guidelines to calculate the fraction of methane in the landfill gas from periodical measurements (Version 01),

Sample Size

Referring to the Guideline, a systematic random sampling scheme should be implemented. All samples taken on the fraction of methane in the landfill gas should be included in the calculations. A minimum of 4 measurements of fraction of methane in the landfill gas per year should be conducted.

For the affected period of GSSF1 during this monitoring period from 01/01/2019 to 25/03/2019, and 31/08/2019 to 12/09/2019, a total number of 16 data was collected. The CH_4 reading was collected in the morning between 0900 – 1100 every week (refer to appendix 4 for the data recording sheet).

Analysis of Data

The data recorded was derived based on 95% confidence interval principles (source: "IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories", page 6.6). The lower bound of the interval boundaries calculated was applied to the affected period as a conservative approach; the detail calculation is described as below.

The following formula explains how to calculate the lower bound of the fraction of methane in the landfill gas.

1. Calculate sample mean (μ).

$$\mu_{WCH4,y} = \frac{\sum_{m=1}^{n_m} w_{CH4,m,y}}{n_m}$$

Where:

$\mu_{WCH4,y}$ = Mean of the fraction of methane in the landfill gas in year y (m^3CH_4/m^3 LFG)
$w_{CH4,m,y}$ = Monitored fraction of methane in the landfill gas in measurement m in year y (m^3CH_4/m^3 LFG)
n_m = Number of measurements m in year y (minimum is 4)

2. Calculate the sample standard deviation (σ).

$$\sigma_{WCH4,y} = \sqrt{\frac{\sum_{m=1}^{n_m} (w_{CH4,m,y} - \mu_{CH4,y})^2}{n_m - 1}}$$

Where:

$\sigma_{WCH4,y}$ = Standard deviation of the fraction of methane in the landfill gas in year y (m^3CH_4/m^3 LFG)

3. Calculate the 95% confidence interval.

$$\mu_{WCH4,y} - t \cdot \frac{\sigma_{WCH4,y}}{\sqrt{n_m}} \leq w_{CH4,y} \leq \mu_{WCH4,y} + t \cdot \frac{\sigma_{WCH4,y}}{\sqrt{n_m}}$$

Where:

t = Value from standard t distribution for a confidence level of 95% with degrees of freedom n_m-1

4. Use the lower bound of the 95% confidence interval obtained below to ensure conservativeness.

$$w_{CH4,lb,y} = \mu_{WCH4,y} - t \cdot \frac{\sigma_{WCH4,y}}{\sqrt{n_m}}$$

Where:

$w_{CH4,lb,y}$ = Lower bound of the 95% confidence interval of fraction of methane in the landfill gas (m^3CH_4/m^3 LFG)

The results calculated using the formula described above is presented as below:

For period from 01/01/2019 to 25/03/2019

Date	$CH_{4,hr}$ reading (%)	$(CH_4 - m_{CH4})^2$
3/1/2019 09:25:00	58.80	0.14207
9/1/2019 09:36:00	59.90	0.52284
17/1/2019 10:17:00	55.50	13.51976
22/1/2019 09:23:00	61.20	4.09284
30/1/2019 10:03:00	61.40	4.94207
7/2/2019 09:47:00	61.90	7.41515
12/2/2019 09:50:00	59.60	0.17899
22/2/2019 09:30:00	58.80	0.14207
27/2/2019 09:45:00	58.40	0.60361
6/3/2019 10:00:00	59.00	0.03130
13/3/2019 10:07:00	58.50	0.45822
20/3/2019 09:55:00	56.20	8.86207
25/3/2019 10:01:00	60.10	0.85207
$m_{CH4,hr}$	**59.2**	
Variance	3.48026	
$s_{CH4,hr} = \sqrt{[\sum (CH_{4,hr} - m_{CH4,hr})^2] / (n_m - 1)}$	1.86554	
$(t \times s_{CH4,hr}) / \sqrt{n_m}$	1.12734	

t (95%; df = 19)	2.17881
n_m	13
df = n_m - 1	12

Calculation of 95% of confidence interval boundaries

Low value	Parameter	High value
58.04959	**≤ $CH_{4,hr}$ ≥**	**60.30426**

The lower bound of the CH4 reading which is 58.05% was applied to the affected period which was from 01/01/2019 to 25/03/2019.

For period from 31/08/2019 to 12/09/2019

There was only three (3) readings collected for this period, a total number of 17 readings from the continuous gas analyser (newly installed on 13/09/2019) was applied for the lower bound calculation.

Date	$CH_{4,hr}$ reading (%)	$(CH_4 - m_{CH4})^2$
8/31/19 10:09 AM	55.10	5.68584
9/4/19 10:15 AM	57.60	23.85834
9/12/19 10:03 AM	52.30	0.17264
9/13/19 11:11 AM	51.94	0.60140
9/13/19 11:12 AM	51.95	0.58599
9/13/19 11:13 AM	51.95	0.58599
9/13/19 11:14 AM	51.99	0.52635
9/13/19 11:15 AM	52.02	0.48372
9/13/19 11:16 AM	52.07	0.41667
9/13/19 11:17 AM	52.12	0.35462
9/13/19 11:18 AM	52.20	0.26574
9/13/19 11:19 AM	52.27	0.19847
9/13/19 11:20 AM	52.34	0.14100
9/13/19 11:21 AM	52.41	0.09333
9/13/19 11:22 AM	52.49	0.05085
9/13/19 11:23 AM	52.55	0.02739
9/13/19 11:24 AM	52.63	0.00731
9/13/19 11:25 AM	52.74	0.00060
9/13/19 11:26 AM	52.79	0.00555
9/13/19 11:27 AM	52.85	0.01809
$m_{CH4,hr}$	**52.71550**	
Variance	1.79368	
$s_{CH4,hr} = \sqrt{[\sum (CH_{4,hr} - m_{CH4,hr})^2] / (n_m}$	1.33928	
$(t \times s_{CH4,hr}) / \sqrt{n_m}$	0.62680	

t (95%; df = 19)	2.09300
n_m	20
$df = n_m - 1$	19

Calculation of 95% of confidence interval boundaries

Low value	Parameter	High value
52.08870	**≤ $CH_{4,hr}$ ≥**	**53.34230**

The lower bound of the CH_4 reading which is 52.09% was applied to the affected period which was from 31/08/2019 to 12/09/2019.

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

The total baseline emissions according to ACM0001 (Version 18.0) were calculated according to the equations below:

$$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y}$$

BE_y	=	Baseline emissions in year *y* (t CO_2e/yr)
$BE_{CH4,y}$	=	Baseline emissions of methane from the SWDS in year *y* (t CO_2e/yr)
$BE_{EC,y}$	=	Baseline emissions associated with electricity generation in year *y* (t CO_2/yr)
$BE_{HG,y}$	=	Baseline emissions associated with heat generation in year *y* (t CO_2/yr)
$BE_{NG,y}$	=	Baseline emissions associated with natural gas use in year *y* (t CO_2/yr)

$$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y}\right) \times GWP_{CH4}$$

$BE_{CH4,y}$	=	Baseline emissions of methane from the SWDS in year *y* (t CO_2e/yr)
OX_{top_layer}	=	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)
$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH_4/yr)
$F_{CH4,BL,y}$	=	Amount of methane in the LFG that would be flared in the baseline in year *y* (t CH_4/yr)
GWP_{CH4}	=	Global warming potential of CH_4 (t CO_2e/t CH_4)

$$F_{CH4,PJ,y} = \eta_{PJ} \times BE_{CH4,SWDS,y}/GWP_{CH4}$$

$F_{CH4,PJ,y}$	=	Amount of methane in the LFG which is flared and/or used in the project activity in year *y* (t CH_4/yr)
$BE_{CH4,SWDS,y}$	=	Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (t CO_2e/yr)
η_{PJ}	=	Efficiency of the LFG capture system that will be installed in the project activity
GWP_{CH4}	=	Global warming potential of CH_4 (t CO_2e/t CH_4)

$$BE_{CH4,SWDS,y} = \varphi_y \times (1 - f_y) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,y} \times MCF_y \times \sum_{x=1}^{y} \sum_{j} \left(W_{j,x} \times DOC_j \times e^{-k_j \times (y-x)} \times \left(1 - e^{-k_j}\right) \right)$$

$BE_{CH4,SWDS,y}$ $PE_{CH4,SWDS,y}$ $LE_{CH4,SWDS,y}$	=	Baseline, project or leakage methane emissions occurring in year *y* generated from waste disposal at a SWDS during a time period ending in year *y* (t CO_2e/yr)
x	=	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year *y* (x = *y*)
y	=	Year of the crediting period for which methane emissions are calculated (*y* is a consecutive period of 12 months)
$DOC_{f,y}$	=	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year *y* (weight fraction)
$W_{j,x}$	=	Amount of solid waste type *j* disposed or prevented from disposal in the SWDS in the year *x* (t)

$$F_{CH4,flared,y} = F_{CH4,sent\_flare,y} - \frac{PE_{flare,y}}{GWP_{CH4}}$$

$F_{CH4,flared,y}$	=	Amount of methane in the LFG which is destroyed by flaring in year *y* (t CH_4/yr)
$F_{CH4,sent\_flare,y}$	=	Amount of methane in the LFG which is sent to the flare in year *y* (t CH_4/yr)
$PE_{flare,y}$	=	Project emissions from flaring of the residual gas stream in year *y* (t CO_2e/yr)
GWP_{CH4}	=	Global warming potential of CH_4 (t CO_2e/t CH_4)

Baseline emissions associated with electricity generation ($BE_{EC,y}$)

$$BE_{EC,y} = \sum_{k} EC_{BL,k,y} \times EF_{EF,k,y} \times \left(1 + TDL_{k,y}\right)$$

$BE_{EC,y}$	=	Baseline emissions from electricity consumption in year *y* (t CO_2 / yr)
$EC_{BL,k,y}$	=	Quantity of electricity that would be consumed by the baseline electricity consumer *k* in year *y* (MWh/yr)
$EF_{EF,k,y}$	=	Emission factor for electricity generation for source *k* in year *y* (t CO_2/MWh)
$TDL_{k,y}$	=	Average technical transmission and distribution losses for providing electricity to source *k* in year *y*
k	=	Sources of electricity consumption in the baseline

Determination of $BE_{CH4,y}$

Flare No.2

Dates	$F_{CH4,flared,y} = F_{CH4,sent\_flare,y} - \frac{PE_{flare,y}}{GWP_{CH4}}$							$F_{CH4,PJ,y} = F_{CH4,flared,y}$	$BE_{CH4} = \left((1 - OX_{top\_layer}) \times F_{CH4,PJ,y} - F_{CH,BL,y}\right) \times GWP_{CH4}$		$BE_y = BE_{CH4,y}$
	Quantity of LFG to Flare No.2 FT2 Flare No.2,y (Nm^3)	Methane average fraction Flare No.2 WCH4	Density of Methane Flare No.2 DCH4 (t/Nm^3)	Amount of methane in LFG sent to Flare No.2 FCH4,sent_flare (t_{CH4})	Project emissions from flaring of residual gas stream PEflare (tCO_2e)	Global Warming Potential Flare No.2 GWPCH4 (tCO_2e/tCH_4)	Amount of methane in LFG destroyed by flaring FCH4,flared (tCH_4)	Amount of methane in LFG flared/used in project activity FCH4, PJ (tCH_4)	Fraction of oxidised methane in LFG in top layer of SWDS in baseline OX_{top_layer}	Baseline emissions of methane from SWDS BE_{CH4} (tCO_2e)	Total Baseline Emission Flare No.2 BE_y (tCO_2e)
01 - 31/01/2019	718,441.06	0.59	0.0007157	305.92	775.82	25	274.89	274.89	0.10	6,185.05	6,185.05
01 - 28/02/2019	597,967.77	0.59	0.0007157	253.32	713.33	25	224.79	224.79	0.10	5,057.68	5,057.68
01 - 31/03/2019	506,362.49	0.58	0.0007157	208.45	900.90	25	172.41	172.41	0.10	3,879.22	3,879.22
01 - 30/04/2019	487,052.02	0.60	0.0007157	208.48	533.08	25	187.16	187.16	0.10	4,211.06	4,211.06
01 - 31/05/2019	297,771.61	0.57	0.0007157	120.93	473.39	25	102.00	102.00	0.10	2,294.98	2,294.98
01 - 30/06/2019	0.00	0.00	0.0007157	0.00	0.00	25	0.00	0.00	0.10	0.00	0.00
01 - 31/07/2019	0.00	0.00	0.0007157	0.00	0.00	25	0.00	0.00	0.10	0.00	0.00
01 - 31/08/2019	0.00	0.00	0.0007157	0.00	0.00	25	0.00	0.00	0.10	0.00	0.00
01 - 30/09/2019	0.00	0.00	0.0007157	0.00	0.00	25	0.00	0.00	0.10	0.00	0.00
01 - 31/10/2019	474,082.31	0.61	0.0007157	208.50	532.59	25	187.19	187.19	0.10	4,211.82	4,211.82
01 - 30/11/2019	562,168.27	0.60	0.0007157	240.65	611.69	25	216.18	216.18	0.10	4,864.06	4,864.06
01 - 31/12/2019	189,712.45	0.60	0.0007157	81.24	208.51	25	72.90	72.90	0.10	1,640.28	1,640.28
01 - 31/01/2020	138,880.51	0.60	0.0007157	59.94	152.93	25	53.82	53.82	0.10	1,211.06	1,211.06

GSS1

Dates	$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y}\right) \times GWP_{CH4}$							
	Density of Methane GSS1 DCH4 (t/Nm3)	Quantity of Landfill Gas Fed into GSS1 FT3 LFG electricity,y (m^3 LFG)	Average methane fraction of the Landfill Gas Fed into GSS1 W_{CH_4}	Amount of methane in LFG used for electricity generation GSS1 $F_{CH4,EL}$ (tCH_4)	Amount of methane in LFG flared/used in project activity GSS1 $F_{CH4, PJ}$ (tCH_4)	Global Warming Potential GSS1 GWP_{CH4} (tCO_2e/tCH_4)	Fraction of oxidised methane in LFG in top layer of SWDS in baseline, GSS1 OX_{top_layer}	Baseline emissions of methane from SWDS GSS1 BE_{CH4} (tCO_2e)
01 - 31/01/2019	0.0007157	788,929.55	0.55	309.72	309.72	25	0.10	6,968.66
01 - 28/02/2019	0.0007157	710,791.25	0.56	286.67	286.67	25	0.10	6,450.00
01 - 31/03/2019	0.0007157	883,852.55	0.55	349.46	349.46	25	0.10	7,862.89
01 - 30/04/2019	0.0007157	826,640.31	0.59	348.18	348.18	25	0.10	7,833.99
01 - 31/05/2019	0.0007157	628,374.32	0.57	256.83	256.83	25	0.10	5,778.70
01 - 30/06/2019	0.0007157	532,855.83	0.58	222.76	222.76	25	0.10	5,012.16
01 - 31/07/2019	0.0007157	557,502.17	0.58	231.10	231.10	25	0.10	5,199.79
01 - 31/08/2019	0.0007157	638,370.83	0.56	253.93	253.93	25	0.10	5,713.53
01 - 30/09/2019	0.0007157	378,914.79	0.53	144.75	144.75	25	0.10	3,256.86
01 - 31/10/2019	0.0007157	219,999.79	0.57	89.77	89.77	25	0.10	2,019.88
01 - 30/11/2019	0.0007157	670,992.62	0.63	300.29	300.29	25	0.10	6,756.59
01 - 31/12/2019	0.0007157	825,253.70	0.65	382.04	382.04	25	0.10	8,595.88
01 - 31/01/2020	0.0007157	804,444.44	0.63	360.98	360.98	25	0.10	8,122.01

GSS2

Dates	$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y} \right) \times GWP_{CH4}$							
	Density of Methane GSS2 DCH4 (t/Nm3)	Quantity of Landfill Gas Fed into the GSS2 FT3 LFG electricity,y (m^3 LFG)	Average methane fraction of the Landfill Gas Fed into the GSS2 WCH4	Amount of methane in LFG used for electricity generation GSS2 FCH4,EL (tCH_4)	Amount of methane in LFG flared/used in project activity GSS2 FCH4, PJ (tCH_4)	Global Warming Potential GSS2 GWPCH4 (tCO_2e/tCH_4)	Fraction of oxidised methane in LFG in top layer of SWDS in baseline GSS2 OX_{top_layer}	Baseline emissions of methane from SWDS GSS2 BE_{CH4} (tCO_2e)
01 - 31/01/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00
01 - 28/02/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00
01 - 31/03/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00
01 - 30/04/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00
01 - 31/05/2019	0.0007157	420,691.46	0.61	183.06	183.06	25	0.1	4,118.80
01 - 30/06/2019	0.0007157	574,204.19	0.60	244.63	244.63	25	0.1	5,504.20
01 - 31/07/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00
01 - 31/08/2019	0.0007157	166,381.60	0.60	71.22	71.22	25	0.1	1,602.56
01 - 30/09/2019	0.0007157	40,913.02	0.59	17.17	17.17	25	0.1	386.28
01 - 31/10/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00
01 - 30/11/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00
01 - 31/12/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00
01 - 31/01/2020	0.0007157	0.00	0.00	0.00	0.00	25	0.1	0.00

GSSF1

$$BE_{CH4} = \left(\left(1 - OX_{top\_layer}\right) \times F_{CH4,PJ,y} - F_{CH,BL,y} \right) \times GWP_{CH4}$$

Dates	Density of Methane GSSF1 DCH4 (t/Nm3)	Quantity of Landfill Gas Fed into GSSF1 FT3 LFG electricity,y (m^3 LFG)	Average methane fraction of the Landfill Gas Fed into GSSF1 W_{CH_4}	Amount of methane in LFG used for electricity generation GSSF1 $F_{CH4,EL}$ (tCH_4)	Amount of methane in LFG flared/used in project activity GSSF1 $F_{CH4,PJ}$ (tCH_4)	Global Warming Potential GSSF1 GWP_{CH4} (tCO_2e/tCH_4)	Fraction of oxidised methane in LFG in top layer of SWDS in baseline, GSSF1 OX_{top_layer}	Baseline emissions of methane from SWDS GSSF1 BE_{CH4} (tCO_2e)
01 - 31/01/2019	0.0007157	326,113.84	0.58	135.48	135.48	25	0.10	3,048.32
01 - 28/02/2019	0.0007157	379,307.85	0.58	157.58	157.58	25	0.10	3,545.55
01 - 31/03/2019	0.0007157	325,516.23	0.58	135.23	135.23	25	0.10	3,042.73
01 - 30/04/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.10	0.00
01 - 31/05/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.10	0.00
01 - 30/06/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.10	0.00
01 - 31/07/2019	0.0007157	0.00	0.00	0.00	0.00	25	0.10	0.00
01 - 31/08/2019	0.0007157	3,230.68	0.52	1.20	1.20	25	0.10	27.10
01 - 30/09/2019	0.0007157	311,137.11	0.53	117.04	117.04	25	0.10	2,633.49
01 - 31/10/2019	0.0007157	391,404.03	0.62	174.03	174.03	25	0.10	3,915.61
01 - 30/11/2019	0.0007157	386,523.84	0.63	174.68	174.68	25	0.10	3,930.34
01 - 31/12/2019	0.0007157	177,654.90	0.62	78.41	78.41	25	0.10	1,764.18
01 - 31/01/2020	0.0007157	321,218.58	0.63	144.24	144.24	25	0.10	3,245.41

Determination of $BE_{EC, y}$

GSS1

Dates	$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EF,k,y} \times (1 + TDL_{k,y})$				$BE_y = BE_{CH4,y} + BE_{EC,y}$
	Quantity of electricity generated GSS 1	Emission factor for electricity generation GSS1	Average technical transmission and distribution losses GSS1	Baseline emission for electricity GSS1	Total Baseline Emissions GSS 1
	$EC_{BL,k}$ (MWh)	$FE_{EL,k}$ (tCO_2/MWh)	TDL_k	$BE_{EC,y}$ (tCO_2)	BE_y (tCO_2e)
01 - 31/01/2019	1,369.45	0.7146	0.0774	1,054.35	8,023.02
01 - 28/02/2019	1,260.18	0.7146	0.0774	970.23	7,420.23
01 - 31/03/2019	1,549.39	0.7146	0.0774	1,192.89	9,055.78
01 - 30/04/2019	1,447.51	0.7146	0.0774	1,114.45	8,948.44
01 - 31/05/2019	1,112.92	0.7146	0.0774	856.85	6,635.55
01 - 30/06/2019	964.50	0.7146	0.0774	742.57	5,754.73
01 - 31/07/2019	930.00	0.7146	0.0774	716.02	5,915.81
01 - 31/08/2019	972.29	0.7146	0.0774	748.57	6,462.11
01 - 30/09/2019	564.67	0.7146	0.0774	434.75	3,691.61
01 - 31/10/2019	1,222.74	0.7146	0.0774	941.40	2,961.28
01 - 30/11/2019	1,097.40	0.7146	0.0774	844.90	7,596.80
01 - 31/12/2019	1,383.40	0.7146	0.0774	1,065.09	9,660.97
01 - 31/01/2020	1,440.16	0.7146	0.0774	1,108.80	9,230.80

GSS2

Dates	$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EF,k,y} \times (1 + TDL_{k,y})$			
	Quantity of electricity generated **GSS 2** **ECBL,k (MWh)**	**Emission factor for electricity generation** **GSS2** **EFEL,k (tCO_2/MWh)**	**Average technical transmission and distribution losses** **GSS2** **TDLk**	**Baseline emission for electricity** **GSS2** **$BE_{EC,y}$ (tCO_2)**
01 - 31/01/2019	0.00	0.7146	0.0774	0.00
01 - 28/02/2019	0.00	0.7146	0.0774	0.00
01 - 31/03/2019	0.00	0.7146	0.0774	0.00
01 - 30/04/2019	0.00	0.7146	0.0774	0.00
01 - 31/05/2019	0.00	0.7146	0.0774	0.00
01 - 30/06/2019	0.00	0.7146	0.0774	0.00
01 - 31/07/2019	0.00	0.7146	0.0774	0.00
01 - 31/08/2019	0.00	0.7146	0.0774	0.00
01 - 30/09/2019	0.00	0.7146	0.0774	0.00
01 - 31/10/2019	0.00	0.7146	0.0774	0.00
01 - 30/11/2019	0.00	0.7146	0.0774	0.00
01 - 31/12/2019	0.00	0.7146	0.0774	0.00
01 - 31/01/2020	0.00	0.7146	0.0774	0.00

GSSF1

Dates	$BE_{EC,y} = \sum_k EC_{BL,k,y} \times EF_{EF,k,y} \times (1 + TDL_{k,y})$			
	Quantity of electricity generated GSSF1 $EC_{BL,k}$ (MWh)	Emission factor for electricity generation GSSF1 $EF_{EL,k}$ (tCO_2/MWh)	Average technical transmission and distribution losses GSSF1 TDL_k	Baseline emission for electricity GSSF1 $BE_{EC,y}$ (tCO_2)
01 - 31/01/2019	460.50	0.7146	0.0774	354.54
01 - 28/02/2019	531.35	0.7146	0.0774	409.09
01 - 31/03/2019	470.41	0.7146	0.0774	362.17
01 - 30/04/2019	0.00	0.7146	0.0774	0.00
01 - 31/05/2019	0.00	0.7146	0.0774	0.00
01 - 30/06/2019	0.00	0.7146	0.0774	0.00
01 - 31/07/2019	0.00	0.7146	0.0774	0.00
01 - 31/08/2019	7.09	0.7146	0.0774	5.46
01 - 30/09/2019	379.53	0.7146	0.0774	292.21
01 - 31/10/2019	542.55	0.7146	0.0774	417.71
01 - 30/11/2019	518.68	0.7146	0.0774	399.34
01 - 31/12/2019	232.04	0.7146	0.0774	178.65
01 - 31/01/2020	443.84	0.7146	0.0774	341.72

For this project, the following applies:

1. With reference to ACM0001, Version 18.0, page 21, $EC_{BL,k,y}$ is equivalent to the net amount of electricity generated using LFG in year *y* ($EG_{PJ,y}$). $EF_{EL,k,y} = EF_{grid,CM,y}$ *and therefore,* $BE_{EC,y} = \sum EG_{PJ,y} \times EF_{grid,CM,y} \times (1 + TDL_{k,y})$.
2. The total electricity generated ($EL_{LFG,y}$) is the amount based on the monthly invoices to the grid operator (Tenaga National Berhad (TNB)) which is also the lower reading from the comparison between (EL4 + EL9 + EL10 + EL12) and (EL5 + EL11 + EL13).

Total Baseline Emissions

$BE_y = BE_{CH4,y} + BE_{EC,y}$

Dates	$BE_{CH4,y}$				$BE_{EC,y}$			Total B_{Ey}
	Flare No.2	GSS1	GSS2	GSSF1	GSS1	GSS2	GSSF1	
01 - 31/01/2019	6,185	6,968	0	3,048	1,054		354	17,609
01 - 28/02/2019	5,057	6,450	0	3,545	970		409	16,431
01 - 31/03/2019	3,879	7,862	0	3,042	1,192		362	16,337
01 - 30/04/2019	4,211	7,833	0	0	1,114		0	13,158
01 - 31/05/2019	2,294	5,778	4,118	0	856		0	13,046
01 - 30/06/2019	0	5,012	5,504	0	742		0	11,258
01 - 31/07/2019	0	5,199	0	0	716		0	5,915
01 - 31/08/2019	0	5,713	1,602	27	748		5	8,095
01 - 30/09/2019	0	3,256	386	2,633	434		292	7,001
01 - 31/10/2019	4,211	2,019	0	3,915	941		417	11,503
01 - 30/11/2019	4,864	6,756	0	3,930	844		399	16,793
01 - 31/12/2019	1,640	8,595	0	1,764	1,065		178	13,242
01 - 31/01/2020	1,211	8,122	0	3,245	1,108		341	14,027
Total	**33,552**	**79,563**	**11,610**	**25,149**	**11,784**	**0**	**2,757**	**164,415**

Note: The Baseline Emission figure has been rounded down for conservativeness

E.2. Calculation of project emissions or actual net removals

The total project emissions according to ACM0001 (Version 18.0) were estimated according to the equations below:

$$PE_y = PE_{EC,y} + PE_{FC,y} + PE_{DT,y} + PE_{SP,y}$$

PE_y	=	Project emissions in year *y* (t CO_2/yr)
$PE_{EC,y}$	=	Emissions from consumption of electricity due to the project activity in year *y* (t CO_2/yr)
$PE_{FC,y}$	=	Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year *y* (t CO_2/yr)
$PE_{DT,y}$	=	Emissions from the distribution of compressed/liquefied LFG using trucks, in year *y* (t CO_2/yr)
$PE_{SP,y}$	=	Emissions from the supply of LFG to consumers through a dedicated pipeline, in year *y* (t CO_2/yr)

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EF,j,y} \times (1 + TDL_{j,y})$$

$PE_{EC,y}$	=	Project emissions from electricity consumption in year *y* (t CO_2 / yr)
$EC_{PJ,j,y}$	=	Quantity of electricity consumed by the project electricity consumption source *j* in year *y* (MWh/yr)
$EF_{EF,j,y}$	=	Emission factor for electricity generation for source *j* in year *y* (t CO_2/MWh)
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
j	=	Sources of electricity consumption in the project

Dates	Electricity consumed by project activity ELPJ,y (MWh)	Coefficient for grid electricity EF grid,y	Transmission and Distribution Losses TDL,y	Total Project Emission from project activity (tCO2e)
01 - 31/01/2019	147.21	0.7146	0.0774	113.34
01 - 28/02/2019	149.10	0.7146	0.0774	114.79
01 - 31/03/2019	158.53	0.7146	0.0774	122.05
01 - 30/04/2019	110.32	0.7146	0.0774	84.94
01 - 31/05/2019	185.98	0.7146	0.0774	143.19
01 - 30/06/2019	222.47	0.7146	0.0774	171.28
01 - 31/07/2019	219.80	0.7146	0.0774	169.22
01 - 31/08/2019	227.06	0.7146	0.0774	174.81
01 - 30/09/2019	238.70	0.7146	0.0774	183.78
01 - 31/10/2019	230.49	0.7146	0.0774	177.45
01 - 30/11/2019	233.55	0.7146	0.0774	179.81
01 - 31/12/2019	207.97	0.7146	0.0774	160.12
01 - 31/01/2020	235.01	0.7146	0.0774	180.94

$PE_{FC,j,y}$, for this project, is the emission from diesel backup generators.

Dates	Quantity of diesel combusted (Liter)	Diesel Density (kg/l)	Quantity of diesel combusted (t/month)	$COEF_{diesel,y} = NCV_{diesel,j} \times EF_{CO2,diesel,y}$			Total Project Emission from project activity
				Weighted average net calorific value of diesel (GJ/t)	Weighted average CO_2 emission factor of diesel	CO_2 emission coefficient of diesel (tCO_2/mass of volume unit)	
			FC_{diesel}	$NCV_{diesel,j}$	$EF_{CO2,diesel,y}$	$COEF_{diesel,y}$	(tCO2e)
01 - 31/01/2019	3	0.84	0.00	43	0.0741	3.19	0.01
01 - 28/02/2019	3	0.84	0.00	43	0.0741	3.19	0.01
01 - 31/03/2019	4	0.84	0.00	43	0.0741	3.19	0.01
01 - 30/04/2019	7	0.84	0.01	43	0.0741	3.19	0.02
01 - 31/05/2019	7	0.84	0.01	43	0.0741	3.19	0.02
01 - 30/06/2019	6	0.84	0.01	43	0.0741	3.19	0.02
01 - 31/07/2019	7	0.84	0.01	43	0.0741	3.19	0.02
01 - 31/08/2019	7	0.84	0.01	43	0.0741	3.19	0.02
01 - 30/09/2019	5	0.84	0.00	43	0.0741	3.19	0.01
01 - 31/10/2019	4	0.84	0.00	43	0.0741	3.19	0.01
01 - 30/11/2019	7	0.84	0.01	43	0.0741	3.19	0.02
01 - 31/12/2019	5	0.84	0.00	43	0.0741	3.19	0.01
01 - 31/01/2020	6	0.84	0.01	43	0.0741	3.19	0.02

Total Project Emissions

$PE_y = PE_{EC,y} + PE_{FC,y}$

Dates	Project Emission from project activity (tCO_2)		Total Project Emission from project activity
	PE_{EC}	PE_{FC}	(tCO2e)
01 - 31/01/2019	113.34	0.01	113.34
01 - 28/02/2019	114.79	0.01	114.80
01 - 31/03/2019	122.05	0.01	122.06
01 - 30/04/2019	84.94	0.02	84.96
01 - 31/05/2019	143.19	0.02	143.21
01 - 30/06/2019	171.28	0.02	171.30
01 - 31/07/2019	169.22	0.02	169.24
01 - 31/08/2019	174.81	0.02	174.83
01 - 30/09/2019	183.78	0.01	183.79
01 - 31/10/2019	177.45	0.01	177.46
01 - 30/11/2019	179.81	0.02	179.83
01 - 31/12/2019	160.12	0.01	160.13
01 - 31/01/2020	180.94	0.02	180.96

Note: The project emission has been rounded up for conservativeness

E.3. Calculation of leakage emissions

No leakage emissions.

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	164,415	1,995	0	N/A	162,420	162,420

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
162,420	299,732*

Notes:
1. Total CER estimated for 2019 (01/01/2019 – 31/12/2019) in PDD version 20.5 is 275,934 tCO_2e
2. Total CER estimated for 2020 (01/01/2020 – 31/12/2020) in PDD version 20.5 is 280,970 tCO_2e, there is 366 days in 2020, as a result, the CER per day for 2020 is 768 tCO_2e, total CER estimated for 01/01/2020 – 31/01/2020 (31 days) is 23,798 tCO_2e. The total CER for the period from 01/01/2019 – 31/01/2020 is 299,732 tCO_2e

E.6. Remarks on increase in achieved emission reductions

The total CERs achieved in the 3rd monitoring period of 2nd crediting period was 46% lower as compared to the value reported in the ex-ante calculations.

The total decrease of 46% is due to the following reasons:

1. Several shutdowns to Flare No.2 from June to Sept 2019.
2. Major overhaul for GSSF1 (Gas Engine No.1) from Apr to Aug 2019.
3. Gas Engine No.4 of GSS2 shutdown due to engine problem, electrical and upgrading works. The power generation from GE4 is considered zero during this monitoring period due to module faulty, major overhaul, electrical and upgrading works and monitoring procedure as per monitoring plan stated in PDD version 20.5, where the lower value between internal and external meter is taken for calculation. As there is no meter reading from external meter are available for GE4, therefore, according to the PDD version 20.5, the lower value which is 0 is applied in the calculation.

E.7. Remarks on scale of small-scale project activity

Not applicable.

Appendix 1: Details on the downtime of Flare No.2

Date	Time		Problem Description
	Shut Down	Restart	
18/01/2019	18:38	19/1/2019 00:43	PT1 below danger set point, Oz above danger set point. GBS trip.
31/01/2019	11:10	12:52	Proper shutdown to Install blower # 1 repaired unit
15/03/2019	18:15	20:23	Oz above danger set point. GBs trip.
14/03/2019	09:35	10:36	Proper shutdown to service blower # 2
30/03/2019	16:17	16:27	TNB Power surge few seconds.
20/4/2019	17:16	22/4/2019 10:26	TNB Power Surge. Blower # 2 trip. GBS trip.
01/06/2019	00:00	30/6/2019 23:59	Proper shutdown to check gas quality
01/07/2019	00:00	31/7/2019 23:59	Proper shutdown to check gas quality
01/08/2019	00:00	31/8/2019 23:59	Proper shutdown to test on gas stability.
01/09/2019	00:00	30/9/2019 23:59	Proper shutdown to test on gas stability.
01/10/2019	00:00	11:10/19 09:59	Proper shutdown to test on gas stability.
12/10/2019	11:40	12:54	Proper shutdown to test on gas stability.
18/10/2019	09:20	09:23	Proper shutdown to test on gas stability.
5/11/2019	17:41	18:00	TNB power surge few seconds.
3/12/2019	05:25	07:55	Motor blower # 1 jammed.
12/12/2019	09:22	31/12/2019 23:59	Proper shutdown to test on gas stability.
01/01/2020	0:00	13/01/2020 05:51	Proper shutdown to test on gas stability.
21/01/2020	09:18	23:59	Proper shutdown to test on gas stability.

Appendix 2: Details on the downtime of Gas Engine No.1, No.2, No.3 and No.4

Gas Engine No.1

Date	Time		Problem Description
	Shut Down	Restart	
06/01/2019	13:56	15:35	Jacket water GK Intel.
08/01/2019	11:48	12:08	Jacket water GK Intel.
09/01/2019	11:23	12:13	Jacket water GK Intel.
20/01/2019	15:46	17:56	Engine speed, compressor problem due to solenoid filter leaking.
22/01/2019	8:09	8:51	TNB power surge few seconds.
23/01/2019	9:44	10:50	Engine speed. Air compressor failure.
28/01/2019	7:30	29/1/2019 16:48	Engine speed. To service at 1000 hrs internal by SPE. Unable to restart, ignition box failure.
15/02/2019	15:30	17:41	Proper shutdown to check CT connection
10/03/2019	17:21	17:32	Jacket water engine outlet.
14/03/2019	10:21	18:22	Proper shutdown for blower GSSF1 service, EL 4 calibration
25/03/2019	12:20	31/8/2019 13:53	GE 1 Major Problem. Major damage to engine block.
04/09/2019	10:33	18:01	Proper shutdown for normal service at 1,500 hrs internals.
05/09/2019	12:12	12:30	Proper shutdown - GSSF1 blower frequency unstable.
06/09/2019	11:39	11:43	CH^4 below set point.
08/09/2019	20:33	21:08	Combustion chamber A3.
10/09/2019	16:25	16:31	Combustion chamber A3.
12/09/2019	8:12	14:54	Proper shutdown to check on scrubber tank condensate water.
13/09/2019	9:25	9:47	Proper shutdown to check on scrubber tank condensate water.
13/09/2019	17:31	19:36	Proper shutdown to modify gas intel pipe to scrubber tank.
18/09/2019	10:51	12:14	Proper shutdown for CDM equipment calibration
24/09/2019	12:01	14:14	Proper shutdown for main pipe phase 3 connection to GBS inlet.
25/09/2019	11:12	13:58	CH_4 below danger set point. To repair Phase 1-8 (1) pipe.
30/09/2019	8:22	8:34	TNB Power surge few second.
03/10/2019	15:46	15:57	TNB power surge few seconds.
04/10/2019	9:52	12:11	Proper shutdown to connect main pipe phase 3 to existing main pipe phase 2B inclined.
14/10/2019	17:27	18:17	Gas pressure gas control system.
23/10/2019	17:55	20:38	Proper shutdown to check Solonoid valve top up tank leaking.
05/11/2019	7:29	8:43	Engine speed, air compressor for solenoid valve faulty.
	17:49	19:13	TNB power surge few seconds.
07/11/2019	10:10	18:19	Proper shutdown for normal service at 1,500 hrs interval
22/11/2019	10:54	11:37	TNB power surge few seconds.
23/11/2019	13:10	15:50	TNB power surge few seconds. TNB power line unstable, due to heavy rain / storm.
26/11/2019	9:26	9:57	Receiver, Combustion chamber A2, Change new spark plug.
30/11/2019	8:07	8:32	Combustion chamber A2.
04/12/2019	18:43	22:24	Jacket water engine outlet.HT pump trip, Contactor faulty.

Date	Time		Problem Description
	Shut Down	Restart	
05/12/2019	11:38	6/12/2019 18:33	Proper shutdown for Pre-treatment service
06/12/2019	20:34	22:44	Jacket water engine outlet. Contactor faulty.
16/12/2019	7:23	31/12/2019 23:59	Combustion chamber A2.
01/01/2020	0:00	04/01/2020 15:08	Combustion chamber A2
16/01/2020	14:02	20:03	Proper shutdown to top up nitrogen gas inside HT expansion tank
25/01/2020	15:08	18:09	TNB power surge few seconds
31/01/2020	09:48	10:03	TNB power surge few seconds

Gas Engine No.2

Date	Time		Problem Description
	Shut Down	Restart	
06/01/2019	14:33	15:02	Jacket water engine outlet.
07/01/2019	15:18	17:42	Jacket water engine outlet.
22/01/2019	8:09	9:09	TNB power surge, few seconds.
28/01/2019	9:54	14:04	Proper shutdown for pipe modification work 315 mm buffer header pipe connection link to GE2/GE3 X GE4 header
	20:37	21:16	Proper shutdown to swap @ check spark with GE1.
29/01/2019	14:24	31/1/2019 23:59	Proper shutdown to swap ignition box with GE1
01/02/2019	0:00	7/2/2019 16:42	Proper shutdown to swap ignition box with GE1
16/02/2019	21:27	21:53	T466 Combustion chamber A6, Change new spark plug.
19/02/2019	11:33	18:31	Proper shutdown to service GE2 at 1,500 hrs
04/03/2019	14:39	14:51	Proper shutdown to check on intake air sensor.
13/03/2019	13:23	13:30	Jacket water engine outlet, HT Fan trip.
14/03/2019	13:49	14:50	Proper shutdown for blower GSS1 service
	15:43	16:36	Proper shutdown to replace intake air cable
30/03/2019	17:02	17:31	TNB Power surge few seconds.
04/04/2019	9:32	10:48	Proper shutdown to check on Jacket water engine outlet temperature high
06/04/2019	19:37	19:53	Combustion chamber A3.
14/04/2019	21:47	15/4/2019 12:22	Proper shutdown - motor blower # 2 GSS1 trip.
17/04/2019	9:34	18/4/2019 22:16	Proper shutdown for normal service at 1,500 hrs. To service per - treatment system :- i.GDU , ii.Scrubber , iii.Radiator.
20/04/2019	17:16	18:02	TNB Power Surge. ACB 4 trip.
	22:41	23:05	GSS 1 trip. PT 2 above danger set point.
22/04/2019	13:32	15:17	Proper shutdown to restart Gas Engines
02/05/2019	5:03	5:14	Jacket water engine outlet.
08/05/2019	11:42	11:54	GSS 1 trip PT above danger set point.
18/05/2019	2:33	9:02	Gas pressure gas control system CH^4 low.
18/05/2019	12:38	29/5/2019	Proper shutdown to restart Gas Engines

Date	Time		Problem Description
	Shut Down	Restart	
		16:04	
09/06/2019	18:21	19:04	TNB Power Surge.
11/06/2019	8:17	8:31	Gas pressure gas control system.
11/06/2019	14:30	17/6/2019 16:04	Gas pressure gas control system
21/06/2019	9:19	9:30	TNB Power Surge.
24/06/2019	9:03	14:44	Proper shutdown to test MN GE 4
09/07/2019	10:03	16:22	Proper shutdown for service GE2 at 1,500 hrs
12/07/2019	15:16	18:36	Proper shutdown to check on gas stability
15/07/2019	12:41	17/7/2019 9:32	Proper shutdown to check on gas stability
26/07/2019	12:24	12:44	Combustion chamber A8. Change new spark plug.
27/07/2019	19:57	20:43	GSS 1 trip, PT2 above danger set point.
28/07/2019	2:16	8:49	GSS 1 trip, PT2 above danger set point.
29/07/2019	10:27	14:37	GSS 1 trip, PT2 above danger set point.
01/08/2019	0:00	18:26	Proper shutdown to check on gas stability
06/08/2019	17:18	19:37	TNB power surge few seconds.
13/08/2019	10:33	10:42	TNB power surge.
20/08/2019	10:42	16:36	Proper shutdown to connect phase 3 pipe line (valve) to incoming main GBS.
21/08/2019	5:48	7:41	Combustion chamber A7.
22/08/2019	15:26	26/8/2019 7:59	Proper shutdown to check on gas stability
26/08/2019	16:00	16:43	Jacket water engine outlet, temperature high.
28/08/2019	21:09	29/8/2019 14:48	Safety Chain. Motor blower #2 jammed.
30/08/2019	19:18	20:54	Combustion chamber A6.
10/09/2019	19:40	30/9/2019 23:59	Combustion chamber A3, coolant leaking
01/10/2019	0:00	11/10/2019 10:19	GSS 1 motor blower # 1 jammed.
11/10/2019	16:08	17/10/2019 12:37	GSS 1 motor blower # 1 jammed.
17/10/2019	14:18	14:36	Combustion chamber B6.
19/10/2019	18:29	19:00	TNB power surge few seconds.
20/10/2019	13:29	13:36	Jacket water engine outlet.
	16:20	16:44	Gas pressure gas control system. RCCB gas analyser panel tripped.
21/10/2019	2:57	3:53	Combustion chamber A6.
	5:53	6:43	Combustion chamber A6.
	7:06	8:30	Combustion chamber A6, change new spark plug.
22/10/2019	9:28	9:36	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
23/10/2019	8:20	19:56	Proper shutdown for normal service at 1,500 hrs
28/10/2019	0:27	0:50	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
30/10/2019	19:23	19:55	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.

Date	Time		Problem Description
	Shut Down	Restart	
04/11/2019	0:15	0:24	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
	3:38	3:40	Combustion chamber B5.
	6:25	7:55	Combustion chamber B5.
05/11/2019	17:33	20:08	TNB power surge few seconds.
06/11/2019	14:21	14:28	Gas pressure gas control system. GSS 3 trip, PT2 high.
07/11/2019	13:22	13:30	Jacket water engine outlet. Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
	14:48	16:44	Proper shutdown to check on 3 way valve, due to jacket water engine outlet high temperature.
	20:21	21:44	Gas pressure gas control system.PT2 high, reading fluctuate.
	23:25	8/11/2019 8:08	Gas pressure gas control system. PT1 high, reading fluctuate. Gas sample inlet pipe block
08/11/2019	13:11	14:05	Combustion chamber A4.
10/11/2019	20:10	19/11/2019 14:19	Deriation power control, engine speed. Actuator faulty.
19/11/2019	19:30	19:35	Combustion chamber B3. Change new spark plug.
20/11/2019	11:43	11:50	Gas pressure gas control system.
	12:40	13:15	Proper shutdown to check on jacket water engine outlet sensor
	15:47	15:52	Proper shutdown to check on jacket water engine outlet sensor
21/11/2019	11:20	16:33	Proper shutdown to swap jacket water engine outlet temperature sensor
22/11/2019	10:54	11:28	TNB power surge few seconds.
	14:45	15:02	Gas pressure gas control system.
23/11/2019	13:07	16:00	TNB power surge few seconds. TNB power line unstable, due to heavy rain / storm.
27/11/2019	16:49	17:29	TNB power surge few seconds.
28/11/2019	15:35	15:44	Combustion chamber B5.
29/11/2019	10:24	10:30	Combustion chamber B5. Clean spark plug.
02/12/2019	8:51	8:57	Gas pressure gas control system. UPS GSS 1 faulty.
03/12/2019	13:56	13:58	Jacket water engine outlet.
04/12/2019	9:21	6/12/2019 11:16	Proper shutdown for Pre-treatment service: Scrubber tank, Radiator, GDU
06/12/2019	12:28	12:42	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
	14:36	16:21	Gas pressure gas control system. GSS 3 trip, CH4 trip. To run engine with GSS 1 gas source.
17/12/2019	17:58	18/12/2019 12:16	Combustion chamber B2. Gas mixture jammed
22/12/2019	1:43	11:23	Actual power - Gas mixture jammed
24/12/2019	22:14	22:26	Combustion chamber A3 faulty. Change new spark plug.
25/12/2019	15:30	15:53	TNB power surge few seconds. ACB 4 trip.
28/12/2019	12:19	12:27	H 116 quick stop with heat removal. Safety chain, reverse power.
31/12/2019	0:33	8:14	H 116 quick stop with heat removal.
	11:31	11:42	H 116 quick stop with heat removal. Safety chain, reverse

Date	Time		Problem Description
	Shut Down	Restart	
			power.
01/01/2020	16:17	08:01	Gas pressure gas control system. GSS 1 trip, UPS failure.
08/01/2020	08:55	20:38	Proper shutdown to service at 1,500 hrs
14/01/2020	21:10	21:28	Combustion chamber A3 - cleaned spark plug.
16/01/2020	20:31	21:12	Gas pressure gas control system. GSS 1 trip.
23/01/2020	13:41	17:46	Combustion chamber B7. Gas mixture jammed.
25/01/2020	15:21	19:07	TNB power surge few seconds.
	20:47	22:57	Combustion Chamber B4.
31/01/2020	09:48	10:13	TNB power surge few seconds.

Gas Engine No.3

Date	Time		Problem Description
	Shut Down	Restart	
05/01/2019	20:22	23:55	Change new spark plug, Combustion chamber A7.
22/01/2019	8:09	9:12	TNB power surge, few seconds.
28/01/2019	9:55	14:10	Proper shutdown for pipe modification work 315 mm buffer header pipe connection link to GE2/GE3 X GE4 header
07/02/2019	9:25	10:03	Proper shutdown to replace GSS1 blower # 2 belting.
18/2/2019	10:08	22:27	Proper shutdown to service GE3 at 1,500 hrs internal
20/2/2019	23:33	21/2/2019	Combustion chamber A1.
		0:49	
21/02/2019	6:32	6:35	Combustion chamber A2.
22/02/2019	8:58	9:03	Combustion chamber A1, A3, change new spark plug.
09/03/2019	15:16	16:52	Combustion chamber B3.
11/03/2019	17:15	17:17	Combustion chamber B3.
14/03/2019	13:48	14:52	Proper shutdown for blower GSS1 service
	16:07	16:11	Combustion chamber A3, change new spark plug.
15/03/2019	18:19	18:37	Combustion chamber B3. Cleaned spark plug.
20/03/2019	17:28	17:31	Combustion chamber B3.
22/03/2019	22:17	22:26	Combustion chamber B3. Cleaned spark plug.
23/03/2019	22:27	22:33	Combustion chamber B3.
26/03/2019	4:18	4:21	Combustion chamber B3.
29/03/2019	20:47	21:02	Combustion chamber B3. Cleaned spark plug.
30/03/2019	16:18	16:55	TNB Power surge few seconds.
07/04/2019	4:36	7:02	Combustion chamber B3. Change new spark plug.
08/04/2019	11:41	14:14	Proper shutdown to check on Gas Engine 3 Sensor.
14/04/2019	20:24	21:48	Gas pressure gas control system. Blower # 2 GSS 1 trip.
15/04/2019	10:01	10:39	Proper shutdown to swap motor blower # 1 with spare unit
17/04/2019	9:35	18/4/2019	Proper shutdown for normal service at 1,500 hrs. To service per - treatment system:- i.GDU , ii.Scrubber , iii.Radiator.
		23:20	
20/04/2019	17:16	18:25	TNB Power Surge. ACB 4 trip.
	22:41	23:09	GSS 1 trip. PT 2 above danger set point.
22/04/2019	13:33	15:22	Proper shutdown to restart gas engine
	17:02	17:12	Combustion chamber A5. Change spark plug.
08/05/2019	11:42	11:58	GSS 1 trip PT above danger set point.
18/05/2019	2:33	9:15	Gas pressure gas control system CH_4 low.

Date	Time		Problem Description
	Shut Down	Restart	
22/05/2019	13:44	15:44	Gas pressure gas control system.
24/05/2019	12:35	29/5/2019 15:51	Proper shutdown for service GE3 at 1,500 hrs
09/06/2019	18:21	19:08	TNB Power Surge.
11/06/2019	8:17	8:35	Gas pressure gas control system.
11/06/2019	17:53	24/6/2019 14:50	Gas pressure gas control system.
27/06/2019	21:46	22:14	Gas pressure gas control system.
10/07/2019	10:19	16:37	Proper shutdown to check on gas stability
17/07/2019	12:04	31/7/2019 23:59	Proper shutdown to check on gas stability.
01/08/2019	0:00	23:42	Proper shutdown to check on gas stability.
06/08/2019	17:18	17:42	TNB power surge few seconds
13/08/2019	10:33	10:47	TNB power surge.
20/08/2019	10:42	16:42	Proper shutdown to connect phase 3 pipe line (valve) to incoming main GBS.
27/08/2019	22:25	23:59	GSS1 trip, Motor blower #2 jammed.
01/09/2019	0:00	11/9/2019 17:51	Motor blower #2 jammed.
18/09/2019	12:25	13:24	Proper shutdown for CDM equipment calibration
24/09/2019	12:02	14:20	Proper shutdown for main pipe phase 3 connection to GBS inlet.
25/09/2019	11:14	14:07	CH_4 below danger set point. To repair Phase 1 - 8 (1) well.
	16:22	16:27	Combustion chamber A6.
30/09/2019	8:22	9:02	TNB power surge few seconds.
	14:06	16:47	CH_4 below danger set point. GBS trip.
03/10/2019	15:45	16:04	TNB power surge few seconds.
04/10/2019	9:53	12:26	Proper shutdown to connect main pipe phase 3 to existing main pipe phase 2B inclined.
	18:49	20:50	Gas pressure gas control system.
07/10/2019	7:14	7:49	Combustion chamber A3. Change new spark plug - Used unit (GE 1).
	10:35	10:48	Combustion chamber B7. Change new spark plug
	16:19	16:24	Combustion chamber A8. Change new spark plug.
	17:46	18:07	Combustion chamber B5. Change new spark plug.
	19:17	19:50	Combustion chamber A6.
	21:35	21:48	Combustion chamber B1.
11/10/2019	9:56	16:31	Proper shutdown for normal service at 1,500 hrs
15/10/2019	10:26	10:29	Combustion chamber, GBS trip.
17/10/2019	11:32	11:38	Proper shutdown to change gas source
19/10/2019	18:29	20:07	TNB power surge few seconds.
20/10/2019	16:20	16:50	Gas pressure gas control system. RCCB gas analyser panel tripped.
22/10/2019	9:28	9:42	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
23/10/2019	18:43	18:54	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
28/10/2019	0:27	0:52	Gas pressure gas control system. GSS 3 trip, CH4 analyser

Date	Time		Problem Description
	Shut Down	Restart	
			trip.
30/10/2019	19:23	19:53	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
04/11/2019	0:15	0:49	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
05/11/2019	17:33	20:48	TNB power surge few seconds.
06/11/2019	14:21	14:35	Gas pressure gas control system. GSS 3 trip, PT2 high.
07/11/2019	13:22	13:33	Gas pressure gas control system. CH4 analyser trip.
	14:50	16:23	Proper shutdown to swap gas source.
	18:45	22:06	Gas pressure gas control system. PT2 high
	23:25	8/11/2019 8:08	Gas pressure gas control system. PT1 high, reading fluctuate
11/11/2019	10:43	11:03	Proper shutdown to swap actuator with GE2 unit.
13/11/2019	11:04	11:15	Combustion chamber B1, B4
	13:22	13:31	Combustion chamber B1. Clean spark plug.
	14:22	14:25	Jacket water engine outlet.
16/11/2019	18:43	18:50	Combustion chamber A2 & A6.
17/11/2019	12:23	12:32	Combustion chamber A2.
18/11/2019	14:58	19/11/2019 16:32	Bellow HT pipe to radiator fan burst.
20/11/2019	11:44	12:42	Gas pressure gas control system.
22/11/2019	10:45	11:25	TNB power surge few seconds.
23/11/2019	13:07	16:16	TNB power surge few seconds. TNB power line unstable, due to heavy rain / storm.
27/11/2019	14:02	14:59	Proper shutdown to install additional sensor for detect engine bearing condition
	16:49	17:34	TNB power surge few seconds.
	18:35	18:51	Combustion chamber A6, B4. Clean spark plug.
28/11/2019	14:11	14:58	Combustion chamber B1.
29/11/2019	11:03	11:22	Combustion chamber A2, B1. Clean spark plug.
02/12/2019	8:51	9:02	Gas pressure gas control system. UPS GSS 1 faulty.
03/12/2019	11:51	11:55	Jacket water engine outlet.
04/12/2019	9:20	6/12/2019 11:06	Proper shutdown for Pre treatment service :- i. Scrubber tank, ii. Radiotor, iii.GDU
06/12/2019	12:28	16:12	Gas pressure gas control system. GSS 3 trip, CH4 analyser trip.
17/12/2019	18:01	18:48	Combustion chamber A2 & B1.
19/12/2019	8:38	21:27	Proper shutdown for normal service at 1,500 hrs
25/12/2019	15:30	16:08	TNB power surge few seconds. ACB 4 trip.
26/12/2019	8:56	9:16	Combustion chamber A3. Clean spark plug.
01/01/2020	06:17	07:57	Gas pressure gas control system. GSS 1 trip, UPS failure.
	08:35	08:56	T20 Receiver - LT Fun trip,
09/01/2020	17:06	18:31	Combustion chamber B4 x B8. Change spark plug.
10/01/2020	14:27	14:40	Jacket water engine outlet.
16/01/2020	08:34	09:14	Combustion chamber A7, B4 - cleaned spark plug.
	14:18	14:28	Jacket water engine outlet.
	20:31	21:10	Gas pressure gas control system. GSS 1 trip.

Date	Time		Problem Description
	Shut Down	Restart	
22/01/2020	22:39	22:51	Combustion chamber A7 & B6. Clean spark plug.
23/01/2020	02:29	02:34	Combustion chamber A6.
25/01/2020	15:21	18:40	TNB power surge few seconds.
31/01/2020	09:20	14:47	Combustion chamber A7 faulty. Clean spark plug.

Gas Engine No.4

Date	Time		Problem Description
	Shut Down	Restart	
01/01/2019	0:00	10/5/2019 20:11	Proper shutdown for eletrical and upgrading work's DG Building/PPU Bukit Tagar.
17/05/2019	9:21	16:33	TNB Power Surge few seconds.
18/05/2019	2:44	10:01	Gas pressure min. CH_4
17/05/2019	9:21	16:33	Work maintenance
19/05/2019	5:17	5:28	Module faulty X - 20.
21/05/2019	12:32	12:42	Tecjet gas pressure min.
22/05/2019	13:08	15:11	Tecjet gas pressure min.
23/05/2019	10:32	10:44	Tecjet gas pressure min.
24/05/2019	22:46	22:54	Tecjet gas pressure min.
27/05/2019	9:11	18:20	Proper shutdown for testing gas pressure
28/05/2019	8:17	29/5/2019 15:54	Gas pressure < minimum.
30/05/2019	9:24	15:11	Gas Pressure < minimum.
31/05/2019	9:27	9:32	Gas Pressure < minimum.
	13:45	23:59	Gas pressure < minimum
	1:55	2:23	Gas Pressure < minimum.
01/06/2019	0:00	12:05	Proper shutdown for pipe modification work's
03/06/2019	10:29	11:08	Module faulty X - 20.
09/06/2019	18:22	19:19	TNB Power Surge.
15/06/2019	17:23	17:32	Module faulty X - 20.
21/06/2019	9:20	10:05	TNB Power Surge.
	23:13	23:31	Module faulty X - 20.
22/06/2019	9:33	9:54	Module faulty X - 20.
24/06/2019	9:04	30/6/2019 23:59	Proper shutdown for gas pipe modification works. Pressure switch inlet valve faulty.
01/07/2019	0:00	31/7/2019 23:59	Proper shutdown for gas pipe modification works. Pressure switch inlet valve faulty.
01/08/2019	0:00	20/8/2019 16:32	Proper shutdown for gas pipe modification works. Pressure switch inlet valve faulty.
20/08/2019	18:39	18:46	Gas pressure low GSS2 pressure unbalance.
	19:56	21:05	Gas pressure low GSS2 pressure unbalance.
22/08/2019	6:24	10:41	Gas pressure low GSS2 trip.
28/8/2019	21:06	21:52	Gas pressure low GSS2 pressure unbalance.
01/09/2019	12:17	12:58	Safety sensor reverse. GSS 2 trip.
04/09/2019	13:56	30/9/2019 23:59	L3 A1 CAN Max Retarded Timing.
01/10/2019	0:00	31/10/2019	L3 A1 CAN Max Retarded Timing. Required top overhaul.

Date	Time		Problem Description
	Shut Down	Restart	
		23:59	
01/11/2019	0:00	30/11/2019	L3 A1 CAN Max Retarded Timing. Required top overhaul.
		23:59	
01/12/2019	0:00	31/12/2019	L3 A1 CAN Max Retarded Timing. Required top overhaul.
		23:59	
01/01/2020	00:00	31/01/2020	L3 A1 CAN Max Retarded Timing.
		23:59	

Appendix 3: Description on the calculation applied in ER Calculation Sheet for Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 03.0

Referring to the tools, for LFG temperatures below 60 °C, moisture could be neglected due to its very low influence on final results and thus, the measurement in wet or dry basis is not important (as reflected in the amendments to ACM 0001, version 9.1 onwards). In the case where the LFG temperature exceeds 60°C, the same basis for both methane concentration and flow measurement will be considered according to the tools.

There are 6 measurement options as tabulated below:

Option	Flow of gaseous stream	Volumetric fraction
A	Volume flow – dry basis	dry or wet basis[3]
B	Volume flow – wet basis	dry basis
C	Volume flow – wet basis	wet basis
D	Mass flow – dry basis	dry or wet basis
E	Mass flow – wet basis	dry basis
F	Mass flow – wet basis	wet basis

During this monitoring period, for Flare No.2 with LFG temperature exceeding 60°C, option B measurement was selected and was applied in the CER calculation.

Determination of the absolute humidity of the gaseous stream

The absolute humidity is a parameter required for Option B. It can be determined from the measurement of moisture content (Option 1) or by assuming the gaseous stream is dry or saturated in a simplified conservative approach (Option 2).

Option 2 which assumes that the gaseous stream is dry or saturated in a simplified conservative approach was selected for the CER calculation.

Option 2: Simplified calculation without measurement of the moisture content

This option provides a simple and conservative approach to determine the absolute humidity by assuming the gaseous stream is dry or saturated depending on which is the conservative situation. If it is conservative to assume that the gaseous stream is dry, then $m_{H2O,t,db}$ is assumed to equal to 0. If it is conservative to assume that the gaseous stream is saturated, then $m_{H2O,t,db}$ is assumed to be equal to the saturation absolute humidity ($m_{H2O,t,db,sat}$) and is calculated using the equation below:

$$m_{H2O,t,db,Sat} = \frac{p_{H2O,t,Sat} \times MM_{H2O}}{(P_t - p_{H2O,t,Sat}) \times MM_{t,db}}$$

Where:

$m_{H2O,t,db,sat}$	=	Saturation absolute humidity in time interval *t* on a dry basis (kg H_2O/kg dry gas)
$p_{H2O,t,Sat}$	=	Saturation pressure of H_2O at temperature T_t in time interval *t* (Pa)
T_t	=	Temperature of the gaseous stream in time interval *t* (K)
P_t	=	Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_{H2O}	=	Molecular mass of H_2O (kg H_2O/kmol H_2O)
$MM_{t,db}$	=	Molecular mass of the gaseous stream in a time interval *t* on a dry basis (kg dry gas/kmol dry gas)

<table>
<tr><th>Parameter</th><th>Formula / description</th></tr>
<tr><td>$p_{H20,t,Sat}$</td><td>
<table>
<tr><td>1</td><td>2</td><td></td></tr>
<tr><td>Filonenko/ Ginzburg (1973) and Filonenko et al. (1971)</td><td>0…100</td><td>$p_s = \exp(6.416 + 17.3 \cdot t / (238+t))$,</td></tr>
</table>
P_s – Saturation pressure of H_2O
t – LFG Temperature</td></tr>
<tr><td>P_t</td><td>
<table>
<tr><td>Absolute Pressure</td></tr>
<tr><td>$P_a = P_g + P_{at}$</td></tr>
<tr><td>$P_a = P_g + 101325$</td></tr>
<tr><td>where,</td></tr>
<tr><td>P_a = Absolute Pressure,</td></tr>
<tr><td>P_g = Gauge Pressure,</td></tr>
<tr><td>P_{at} = Atmospheric Pressure.</td></tr>
</table>
</td></tr>
<tr><td>MM_{H2O}</td><td>18.0152 kg/kmol
Default value from the tool</td></tr>
<tr><td>$MM_{t,db}$</td><td>$$MM_{t,db} = \sum_k (v_{k,t,db} * MM_k)$$
Where:
$MM_{t,db}$ = Molecular mass of the gaseous stream in time interval *t* on a dry basis (kg dry gas/kmol dry gas)
$v_{k,t,db}$ = Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a dry basis (m^3 gas k/m^3 dry gas)
MM_k = Molecular mass of gas *k* (kg/kmol)
k = All gases, except H_2O, contained in the gaseous stream (e.g. N_2, CO_2, O2, CO, H2, CH_4, N_2O, NO, NO2, SO_2, SF_6 and PFCs). See available simplification below

Default value for $MM_{i,k}$, Gases involve in the calculation are CH_4, CO_2, and O_2</td></tr>
</table>

Parameter	Formula / description

Data / Parameter:	MM_i
Data unit:	kg/kmol
Description:	Molecular mass of greenhouse gas *i*
Value to be applied:	

Compound	Structure	Molecular mass (kg / kmol)
Carbon dioxide	CO_2	44.01
Methane	CH_4	16.04
Nitrous oxide	N_2O	44.02
Sulfur hexafluoride	SF_6	146.06
Perfluoromethane	CF_4	88.00
Perfluoroethane	C_2F_6	138.01
Perfluoropropane	C_3F_8	188.02
Perfluorobutane	C_4F_{10}	238.03
Perfluorocyclobutane	c-C_4F_8	200.03
Perfluoropentane	C_5F_{12}	288.03
Perfluorohexane	C_6F_{14}	338.04

Any comment:	

Data / Parameter:	MM_k
Data unit:	kg/kmol
Description:	Molecular mass of gas *k*
Value to be applied:	For gases *k* that are greenhouse gases appy values for MM_i.

Compound	Structure	Molecular mass (kg / kmol)
Nitrogen	N_2	28.01
Oxygen	O_2	32.00
Carbon monoxide	CO	28.01
Hydrogen	H_2	2.02
Nitric oxide	NO	30.01
Nitrogen dioxide	NO_2	46.01
Sulfur dioxide	SO_2	64.06

Any comment:	

Option B of measurement options

The volumetric flow of the gaseous stream in time interval *t* on a dry basis ($V_{t,db}$) is determined by converting the measured volumetric flow from wet basis to dry basis as follows:

$$V_{t,tb} = V_{t,wb}/(1 + v_{H2O,t,db})$$

Where:

$V_{t,db}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3 dry gas/h)

$V_{t,wb}$ = Volumetric flow of the gaseous stream in time interval *t* on a wet basis (m^3 wet gas/h)

$v_{H2O,t,db}$ = Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m^3 H_2O/m^3 dry gas)

The volumetric fraction of H_2O in time interval *t* on a dry basis ($v_{H2O,t,db}$) is estimated according to the equation below:

$$v_{H2O,t,db} = \frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}}$$

Where:

$v_{H2O,t,db}$ = Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis (m^3 H_2O/m^3 dry gas)

$m_{H2O,t,db}$ = Absolute humidity in the gaseous stream in time interval *t* on a dry basis (kg H_2O/kg dry gas)

$MM_{t,db}$ = Molecular mass of the gaseous stream in time interval *t* on a dry basis (kg dry gas/kmol dry gas)

MM_{H2O} = Molecular mass of H_2O (kg H_2O/kmol H_2O)

The absolute humidity of the gaseous stream ($m_{H2O,t,db}$) is determined using Option 2 above ($MM_{t,db}$) which is as demonstrated above.

Example of the calculation using the *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*, version 03.0.

ID	Date	TT1(°C)	TT3(°C)	PT1(kPa)	PT2(kPa)	CH4(%)	CO2(%)	O2(%)	FT1(Nm3/h)	T2(Nm3/h)	MO2	MCH4	MCO2	MMt,db	MH2O	Patm	Pt	PH2O,T,SAT	mH2O,t,db,SAT	vH2O,t,db	Calculated VFT1,t,db	Calculated VFT2,t,db	New FT2
40	9/17/12 0:1	54.59	855.47	-6.62	18.56	56.23	41.01	1.48	1734.53	1735.36	2.00	16.04	44.01	27.5414	18.0152	101325	119885	15425.0598	0.0966	0.1477	1511.3559	1512.079	1735.36
41	9/17/12 0:1	54.56	8					1.46	1732.16	1732.06						52	101325	119795	1540				9 1732.06
42	9/17/12 0:2	54.58	8					1.44	1738.58	1735.62						52	101325	119845	1541				5 1735.62
43	9/17/12 0:2	54.52	8					1.44	1739.38	1738.58						52	101325	119835	1537				8 1738.58
44	9/17/12 0:2	54.48	8					1.45	1729.11	1729.14						52	101325	119755	1534				5 1729.14
45	9/17/12 0:2	54.45	8					1.44	1738.51	1737.52						52	101325	119845	1532				0 1737.52
46	9/17/12 0:2	54.45	8					1.42	1740.07	1731.62						52	101325	119885	1532				2 1731.62
47	9/17/12 0:2	54.45	8					1.42	1744.68	1740.56	2.00	16.04	44.01	27.7107	18.0152	101325	119845	1532					4 1740.56
48	9/17/12 0:2	54.45	8					1.41	1730.11	1730.75	2.00	16.04	44.01	27.5926	18.0152	101325	119815	1532					1 1730.75
49	9/17/12 0:2	54.46	863.3	-6.69	18.51	56.32	41.18	1.41	1736.86	1736.63	2.00	16.04	44.01	27.6082	18.0152	101325	119835	1532					4 1736.63
50	9/17/12 0:2	54.45	862.88	-6.66	18.52	56.35	41.28	1.42	1739.13	1738.74	2.00	16.04	44.01	27.6603	18.0152	101325	119845	1532					1 1738.74
51	9/17/12 0:2	54.45	861.84	-6.83	18.46	56.33	41.38	1.42	1736.58	1736.99	2.00	16.04	44.01	27.7011	18.0152	101325	119785	1532					5 1736.99
52	9/17/12 0:3	54.47	861.23	-6.64	18.51	56.55	41.25	1.42	1738.74	1738.31	2.00	16.04	44.01	27.6791	18.0152	101325	119835	1533					4 1738.31
53	9/17/12 0:3	54.45	861.38	-6.62	18.38	56.29	41.22	1.39	1726.35	1725.67	2.00	16.04	44.01	27.6146	18.0152	101325	119705	1532					0 1725.67
54	9/17/12 0:3	54.33	860.02	-6.57	18.38	56.41	41.26	1.4	1729.69	1729.51	2.00	16.04	44.01	27.6547	18.0152	101325	119705	15233.2038	0.0950	0.1458	1509.5762	1509.41	1 1729.51
55	9/17/12 0:3	54.34	859.92	-6.88	18.17	56.61	41.24	1.4	1715.27	1714.58	2.00	16.04	44.01	27.6780	18.0152	101325	119495	15240.5448	0.0952	0.1462	1496.5023	1495.90	3 1714.58
56	9/17/12 0:3	54.33	860.91	-6.81	18.26	56.55	41.41	1.35	1718.76	1718.25	2.00	16.04	44.01	27.7272	18.0152	101325	119585	15233.2038	0.0948	0.1460	1499.8176	1499.37	6 1718.25
57	9/17/12 0:3	54.36	863.2	-6.65	18.33	56.76	41.37	1.32	1723.68	1723.68	2.00	16.04	44.01	27.7336	18.0152	101325	119655	15255.2360	0.0949	0.1461	1503.9220	1503.92	0 1723.68
22	9/17/12 0:0	54.71	867.23	-6.92	18.34	56.34	41.35	1.39	1726.12	1723.94	2.00	16.04	44.01	27.6799	18.0152	101325	119665	15514.3056	0.0969	0.1490	1502.3323	1500.43	9 1723.94
23	9/17/12 0:0	54.68	866.77	-6.67	18.5	56.53	41.49	1.36	1741.43	1740.42	2.00	16.04	44.01	27.7624	18.0152	101325	119825	15491.9527	0.0964	0.1485	1516.2837	1515.40	3 1740.42
24	9/17/12 0:0	54.69	866.53	-6.73	18.4	56.5	41.41	1.36	1737.25	1736.15	2.00	16.04	44.01	27.7223	18.0152	101325	119725	15499.4006	0.0966	0.1487	1512.3485	1511.39	9 1736.15
25	9/17/12 0:0	54.66	864.89	-6.51	18.6	56.35	40.96	1.37	1735.63	1734.69	2.00	16.04	44.01	27.5034	18.0152	101325	119925	15477.0661	0.0971	0.1482	1511.6362	1510.81	5 1734.69
26	9/17/12 0:0	54.68	863.16	-6.51	18.62	56.33	41.05	1.41	1739.65	1739.17	2.00	16.04	44.01	27.5526	18.0152	101325	119945	15491.9527	0.0970	0.1483	1514.9589	1514.54	0 1739.17

LFG Temperature > 60ºC

Original value for FT2

FT2 calculated using the tool and is applied in the CER calculation

Appendix 4: CH4 Manual Recording Using Portable Analyser for GSSF1

KUB BERJAYA Enviro SDN BHD

RE CENTRE OPERATION **Equipment**

CH4 MANUAL RECORDING FOR GSSF1 **Geotech GA5000**

Date	Time	CH4 Value	Recorded By	Remarks
03/01/2019	09:25	58.8	MUS	
09/01/2019	09:36	59.9	MUS	
17/01/2019	10:17	55.5	MUS	
22/01/2019	09:23	61.2	MUS	
30/01/2019	10:03	61.4	MUS	
07/02/2019	09:47	61.9	MUS	
12/02/2019	09:50	59.6	MUS	
22/02/2019	09:30	58.8	MUS	
27/02/2019	09:45	58.4	MUS	
06/03/2019	10:00	59.0	MUS	
13/03/2019	10:07	58.5	MUS	
20/03/2019	09:55	59.2	MUS	
25/03/2019	10:01	60.1		

KUB BERJAYA Enviro SDN BHD

RE CENTRE OPERATION **Equipment**

CH4 MANUAL RECORDING FOR GSSF1 **Geotech GA5000**

Date	Time	CH4 Value	Recorded By	Remarks
31/08/2020	10:09	55.1	Mus	
04/09/2020	10:15	57.6	Mus	
12/09/2020	10:03	52.3	Mus	

Document information

Version	*Date*	*Description*
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

Version	*Date*	*Description*

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: monitoring report